

UBS Global I/O Semiconductors

Cycle Update: Was the recent rally in semis stocks premature?

A near term pullback is possible, but could be short-lived

Back in June, we highlighted that global semis stocks were discounting a c. 50-60% probability of a global recession on end demand and macro uncertainty ([link](#)). Since, consensus 2023 net earning forecasts for semis have been cut c. 12% on average. Forward PE has held up to 14.4x '23E, a 10% discount to mid-cycle levels. Hence there is still room for semis stocks to let some steam off near term, especially after a 12% rally from the early July trough (taking into account the 11% correction from early August levels). At the same time, we may be more than half-way before those earnings cuts stop to matter altogether for the semis stocks. With 1/ lead indicators troughing by 4Q22-2Q23; 2/ investors underweight some of the universe (Asia, Memory mostly) - we would not want to overstay a more bearish positioning. We would recommend investors to soon start sizing up select semis stocks with favourable risk/reward.

Inventory growth has peaked as customers accelerate de-stocking

For the recent June/July Q-end, OEM average inventory days was up both QoQ and YoY to 75.7 days (up 2.3 days QoQ and 12.6 days YoY). Similarly, non-memory semis vendor inventory days averaged 122.2 days, also up both QoQ and YoY (up 4.0 days QoQ and 21.7 days YoY). Most notably however, inventory days growth for both OEMs and non-memory semis vendors did show a slow down QoQ. While the inventory correction will continue into 1H23, we have likely passed a peak for actual inventory days.

ASP support to revenue growth is still significant & to vanish by 2023

We forecast overall semis industry (Sell In) revenues of US\$615bn for '22E (+10.6% YoY) and for '23E to US\$618bn or +0.5% YoY, compared to US\$651bn/US\$721bn prior; this largely reflects our already revised down memory revenue ests ([link](#)). We forecast non-memory semis revenue to grow 14.9% YoY in 2022, unchanged, but lower growth of 3.3% YoY in 2023 (was +5.0%) We forecast the strong YoY ASP growth that characterizes 2022 (+13% YoY ex memory) to largely normalize with YoY ASP decelerating to +1% only in 2023. This will add to semis unit shipments under-shooting end demand in 1H23, as the inventory correction continues.

Some semis stocks now offer compelling value

Most Preferred: Key Call Buy SK Hynix and Buy-rated ADI, ASMI, AVGO, Infineon, MRVL, Mediatek, MU, Samsung, TSMC. Least Preferred: GigaDevice, Melexis, NXP, SMIC, TXN, Vanguard.

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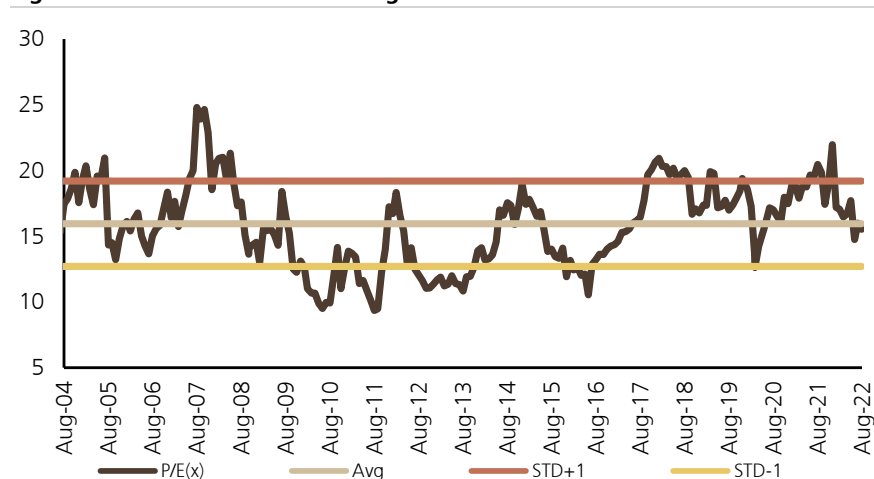
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Figure 1: UBS Global Semis Most/Least preferred list

Company	Ticker	Rating	Price	PT	'22E PE	'23E PE	'22E PB	'23E PB
Most preferred								
Analog Devices	ADI.O	Buy	US\$155.2	US\$210	16.4	15.9	2.22	2.27
ASMI	ASMI.AS	Buy	€275.9	€370	23.1	25.0	4.82	4.32
Broadcom	AVGO.O	Buy	US\$514.2	US\$690	12.7	11.7	12.70	13.11
Infineon	IFXGn.DE	Buy	24	€40	12.5	13.8	2.44	2.23
Marvell	MRVL.O	Buy	US\$49.0	US\$80	37.6	20.6	3.26	2.67
MediaTek	2454.TW	Buy	NT\$653	NT\$1030	8.2	8.9	2.40	2.45
Micron	MU.O	Buy	US\$57.0	US\$80	7.0	23.8	1.27	1.27
Samsung Electronics	005930.KS	Buy	Won58,600	Won81,000	9.4	10.9	1.01	0.94
SK Hynix	000660.KS	Buy	Won92,500	Won155,000	7.9	17.3	0.96	0.92
TSMC	2330.TW	Buy	NT\$498.5	NT\$815	13.2	12.9	4.47	3.58
Least preferred								
GigaDevice	603986.SS	Neutral	Rmb114.5	Rmb155	28.5	25.0	4.94	4.32
Melexis	MLXS.BR	Sell	76	€67	15.9	17.7	7.19	6.27
NXP	NXPI.O	Sell	US\$165.9	US\$160	11.4	11.7	6.97	6.14
SMIC	0981.HK	Sell (CBE)	HKD15.3	HKD14	8.0	9.7	0.57	0.54
Texas Instruments	TXN.O	Neutral	US\$167.9	US\$165	16.9	19.9	9.91	8.22
Vanguard	5347.TWO	Sell	NT\$73.2	NT\$55	7.7	11.8	2.69	2.53

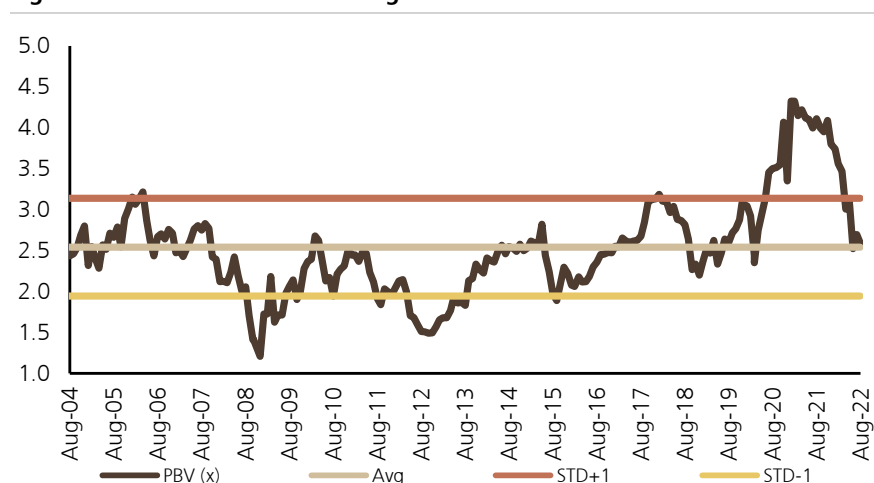
Source: UBS estimates. Priced as of 29 August 2022.

Figure 2: Global Semis NTM average P/E



Source: Company data, UBS estimates. Priced as of 29 August 2022.

Figure 3: Global Semis NTM average P/BV



Source: Company data, UBS estimates. Priced as of 29 August 2022.

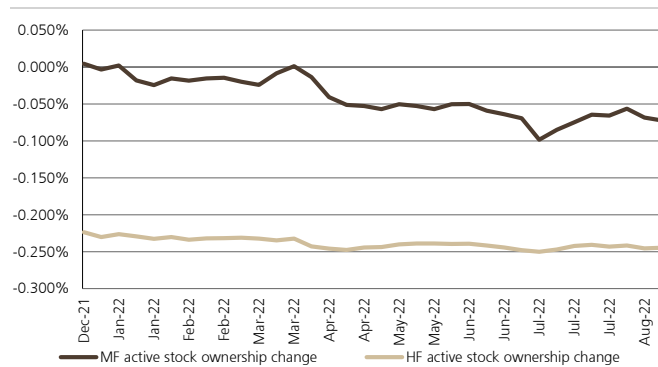
Valuation

Figure 4: UBS Global Semis Valuation

					EV/Sales		EV/EBITDA		PE		PB	
Semiconductors	Rating	Mkt Cap (US\$m)	Price	Price Target	22E	23E	22E	23E	22E	23E	22E	23E
Analog/Diversified												
Analog Devices	Buy	80,669	US\$ 155.19	US\$ 210	7.0	6.8	10.3	10.0	16.4	15.9	2.22	2.27
GigaDevice	Neutral	11,061	Rmb 114.49	Rmb 155	6.3	5.0	23.5	19.9	28.5	25.0	4.94	4.32
Infineon	Buy	31,538	€ 29.61	€ 40	2.6	2.4	8.0	7.9	12.5	13.8	2.44	2.23
Maxscend Microelectronics	Neutral	7,129	€ 92.28	€ 155	8.0	6.0	19.7	14.8	22.9	18.0	5.15	4.08
Melexis	Sell	3,051	€ 75.55	€ 67	3.6	3.5	11.2	12.0	15.9	17.7	7.19	6.27
Microchip Technology	Buy	35,435	US\$ 64.71	US\$ 100	7.3	5.1	12.2	8.8	16.3	11.3	7.20	5.40
Nordic semiconductor ASA	Neutral	2,936	Nkr 149.5	Nkr 165	3.2	2.6	12.6	11.9	23.7	22.2	5.00	4.08
NXP Semiconductor	Sell	43,641	US\$ 165.88	US\$ 160	3.7	3.5	8.0	7.9	11.4	11.7	6.97	6.14
Onsemi	Neutral (CBE)	29,935	US\$ 69.52	US\$ 68	3.8	3.6	9.5	9.2	13.2	13.7	4.77	3.83
Qorvo	Neutral	10,543	US\$ 93.8	US\$ 120	4.2	2.8	13.6	13.7	13.3	11.7	4.01	2.34
Renesas Electronics	Buy	16,789	¥ 1304	¥ 3400	1.9	1.5	4.2	3.4	5.6	5.4	1.55	1.29
Rohm	Buy	7,250	¥ 10240	¥ 13700	1.2	1.2	4.4	4.2	16.4	15.9	1.14	1.09
Sileqy	Buy	6,739	¥ 540	¥ 725	6.7	5.2	20.6	15.2	23.9	17.4	5.52	4.42
Skyworks	Neutral (UR)	16,657	US\$ 100.83	US\$ 133	2.8	2.9	5.8	6.0	9.0	8.8	3.06	2.75
STMicroelectronics	Neutral	32,191	€ 37.69	€ 40	1.9	1.9	5.0	4.9	9.3	10.6	2.65	2.15
Texas Instruments	Neutral	155,009	US\$ 167.94	US\$ 165	7.5	8.0	13.0	14.4	16.9	19.9	9.91	8.22
Average					4.5	3.9	11.3	10.3	15.9	14.9	4.61	3.81
Logic												
Advanced Micro Dev	Neutral (CBE)	143,531	US\$ 88.49	US\$ 120	5.3	4.5	22.4	13.9	21.1	18.0	2.53	2.32
Broadcom	Buy	207,635	US\$ 514.18	US\$ 690	7.2	6.8	9.5	9.2	12.7	11.7	12.70	13.11
Intel	Neutral	133,769	US\$ 32.94	US\$ 41	2.1	1.9	5.7	4.5	14.1	10.8	1.28	1.24
Marvell Technology	Buy	41,666	US\$ 48.99	US\$ 80	10.9	7.4	NM	NM	37.6	20.6	3.26	2.67
MediaTek	Buy	34,368	NT\$ 653	NT\$ 1030	1.4	1.3	5.1	5.4	8.2	8.9	2.40	2.45
NVIDIA	Buy	395,657	US\$ 158.01	US\$ 220	18.5	14.3	35.8	35.2	45.4	45.4	19.29	18.84
Qualcomm Inc.	Neutral	154,763	US\$ 137.08	US\$ 155	3.6	3.5	9.4	9.3	10.8	11.8	8.42	6.18
Average*					5.1	4.2	7.4	7.1	11.5	10.8	7.12	6.69
Memory												
Micron Technology	Buy	64,022	US\$ 57.01	US\$ 80	2.0	2.4	3.6	5.9	7.0	23.8	1.27	1.27
Samsung Electronics	Buy	259,602	Won 58600	Won 81000	1.1	1.0	3.5	2.8	9.7	7.5	1.52	1.32
SK Hynix	Buy	49,972	Won 92500	Won 155000	1.7	1.3	3.0	2.2	5.6	3.5	1.26	0.95
Western Digital	Neutral	13,876	US\$ 44.76	US\$ 50	1.1	1.0	7.3	7.4	19.0	20.0	1.32	1.16
Average					1.5	1.5	4.4	4.6	10.3	13.7	1.34	1.18
Foundries												
Hua Hong Semicon	Sell	3,882	HK\$ 23.4	HK\$ 17.5	2.0	2.3	5.1	6.2	10.5	16.9	1.26	1.18
SMIC	Sell (CBE)	15,410	HK\$ 15.3	HK\$ 14	1.9	2.0	3.3	3.8	NM	NM	0.57	0.54
TSMC	Buy	425,492	NT\$ 498.5	NT\$ 815	5.5	5.0	8.1	7.4	13.2	12.9	4.47	3.58
UMC	Neutral	16,068	NT\$ 39.95	NT\$ 37	1.3	1.5	2.5	3.2	5.7	9.0	1.50	1.61
Vanquard	Sell	3,949	NT\$ 73.2	NT\$ 55	1.9	2.0	4.2	4.8	7.7	11.8	2.69	2.53
Win Semis	Neutral	2,240	NT\$ 160.5	NT\$ 166	3.4	3.0	10.2	7.4	38.5	18.9	2.02	1.87
Average					2.7	2.6	5.5	5.4	15.1	13.9	2.09	1.88
OSAT												
ASE	Neutral	12,249	NT\$ 84.4	NT\$ 88	0.7	0.7	3.4	3.3	6.0	7.7	1.23	1.19
Huatai Technology	Neutral	4,388	Rmb 9.46	Rmb 9.7	2.5	2.2	10.1	8.7	30.1	31.6	1.91	1.81
Inari	Buy	1,896	RM 2.69	RM 4.6	5.8	3.2	16.8	10.0	27.3	19.8	4.53	3.82
JCET Group	Buy	6,354	Rmb 24.67	Rmb 35	1.4	1.3	6.9	6.6	14.7	14.6	1.86	1.68
Average					2.6	1.9	9.3	7.1	19.6	18.4	2.38	2.12
Silicon Wafers												
GWC	Neutral	6,748	NT\$ 471	NT\$ 465	2.4	2.2	5.3	4.8	14.2	10.0	3.81	3.30
Shin-Etsu	Neutral	49,402	¥ 16435	¥ 17300	2.1	2.5	4.9	6.2	10.8	14.4	1.98	1.92
Siltronic	Neutral	2,052	€ 68.45	€ 85	1.3	1.3	3.7	3.3	5.8	5.8	1.15	0.88
SUMCO	Neutral	4,009	¥ 1915	¥ 2050	1.2	1.1	2.9	2.6	8.7	8.3	1.18	1.08
Soitec	Buy	5,010	¥ 144.5	¥ 211	4.4	3.4	13.2	9.8	23.1	17.4	4.00	3.21
Average					1.8	1.8	4.2	4.3	9.9	9.6	2.03	1.79
Semiscap												
Applied Materials	Neutral (CBE)	83,985	US\$ 96.54	US\$ 100	3.4	3.3	10.5	10.2	12.4	11.4	7.28	7.23
ASMP	Buy	3,225	HK\$ 61.35	HK\$ 100	1.1	1.1	5.2	5.6	8.5	10.2	1.51	1.40
ASMI	Buy	13,425	€ 275.9	€ 370	5.3	5.3	16.8	16.2	23.1	25.0	4.82	4.32
ASML	Neutral	200,616	€ 503.3	€ 630	8.9	7.4	25.2	19.4	31.7	24.1	17.89	12.84
BE Semiconductor	Buy	3,721	€ 48	€ 80	4.5	4.5	10.4	9.4	15.0	14.0	5.21	4.96
Disco	Neutral	8,814	¥ 33850	¥ 31000	4.0	4.2	9.7	11.0	16.7	20.1	3.66	3.43
Entegris Inc	Neutral	13,060	US\$ 96.31	US\$ 120	4.1	3.2	12.8	10.1	22.8	19.2	6.23	4.95
Eugene Technology	Buy	434	Won 25550	Won 42000	1.5	1.4	6.9	8.1	11.4	16.0	1.70	1.55
KLA Corporation	Neutral	53,820	US\$ 353.38	US\$ 345	6.0	5.2	13.9	12.0	16.8	14.5	37.72	35.34
LAM Research	Buy	62,991	US\$ 444.54	US\$ 530	4.7	3.1	14.3	9.2	17.2	11.0	12.58	7.68
SCREEN Holdings	Buy	3,218	¥ 9410	¥ 14700	0.6	0.5	3.1	2.8	7.5	8.3	1.49	1.26
Teradyne	Buy	14,266	US\$ 87.63	US\$ 120	4.4	3.5	15.6	11.1	22.1	14.1	6.56	5.30
Tokyo Electron	Neutral	48,916	¥ 43530	¥ 62000	2.7	2.6	8.3	8.0	13.2	13.1	4.23	3.64
Wonik IPS	Neutral	972	Won 27150	Won 31000	1.0	1.0	6.8	8.0	11.9	23.6	1.49	1.43
Average					3.7	3.3	11.4	10.1	16.4	16.0	8.02	6.81
Sector / Regional Avg												
US Semis					5.5	4.6	12.3	10.9	17.8	16.3	7.93	6.91
Europe Semis					4.0	3.6	11.8	10.5	17.8	16.7	5.60	4.55
Asia Semis					2.9	2.4	8.5	7.4	15.7	14.9	2.57	2.25
Japan Semis					2.0	1.9	5.4	5.5	11.3	12.2	2.18	1.96
GLOBAL SEMIS*					3.4	3.0	9.0	8.1	14.6	14.2	4.51	3.88

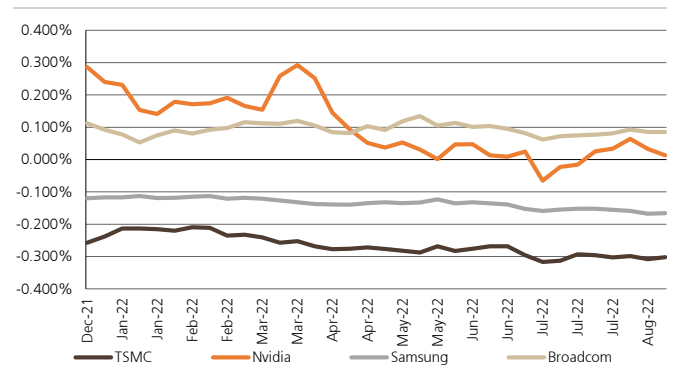
Source: UBS estimates. Priced as of 29 August 2022; *Excluding AMD, Marvell, Nvidia, Qualcomm and A-shares.

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

Getting closer to lead indicators throughing

Back in June, we highlighted that global semis stocks were discounting a 50-60% probability of a global recession on the back of uncertainty on end-demand and macro/inflation concerns. Though stocks since then have seen little support, incremental from our last update is that **we have begun seeing a faster adjustment down of '23E earnings forecasts, brought down c. 12% over the past few weeks alone. This leaves the group now trading at 14.4x NTM PE.**

Semis cycle lead indicators **are now closer to a trough (4Q22-2Q23 depending) where we could soon be seeing defined momentum support.**

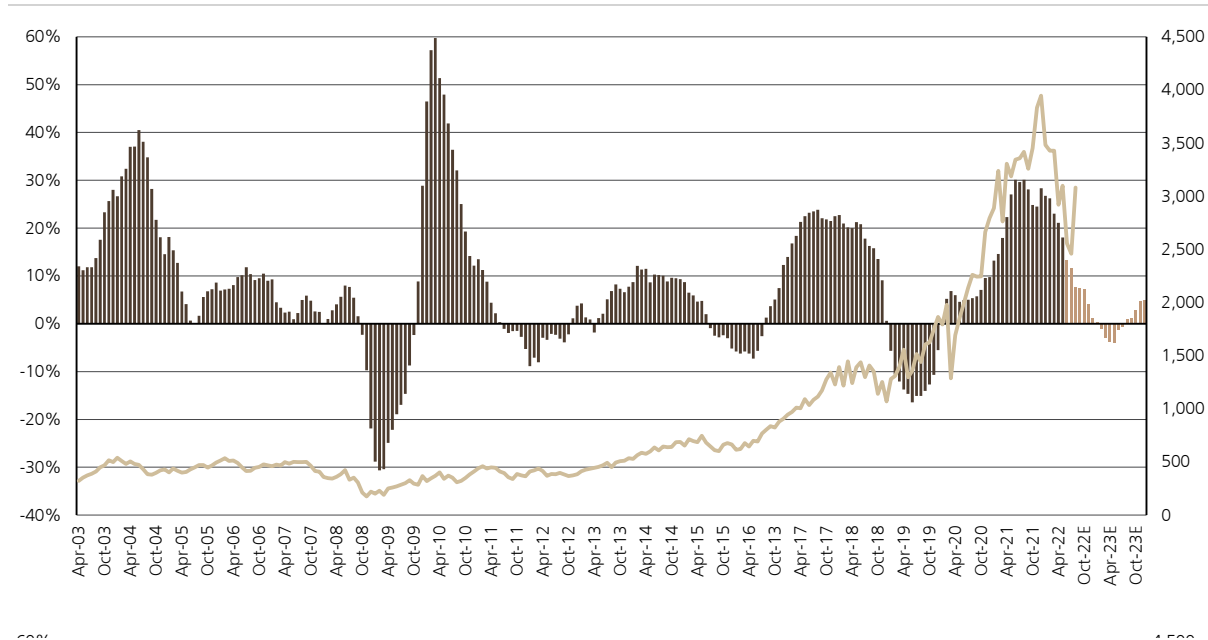
1/ Macro lead indications including the PMI/Global Growth Surprise Index (Figures 10 & 11) have continued to trend down throughout 2Q22 from their recent highs, **now nearing levels where we might soon be seeing support for semis stocks** - when PMI falls below the 50 mark.

2/ 3MMA semis industry revenues and 3MM semis (ex-memory) industry revenues growth YoY (Figures 5 & 6), we expect, will trough out in 2Q23 with prior cycles suggesting that stocks in relation trough 2-3 quarters ahead (implying 4Q22-1Q23).

3/ We continue to expect foundry capacity utilization rates (Figure 8) to trough in 1Q23 with respective stocks typically troughing c. 1-2 quarters ahead (suggesting 3Q-4Q22).

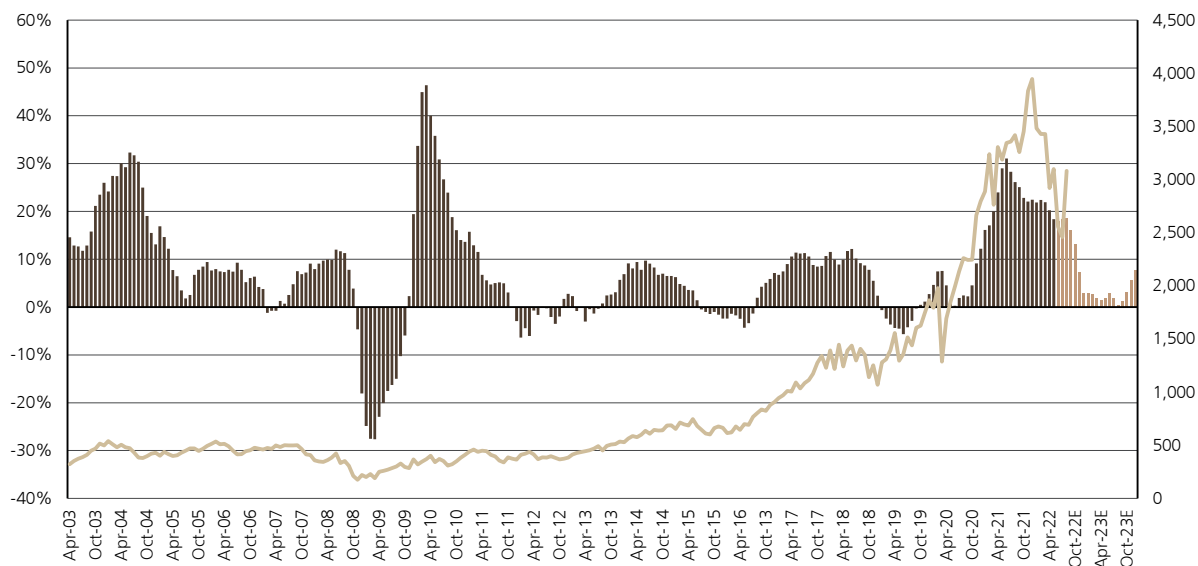
4/ Most incremental from our last update in June, we have seen forward earnings forecasts continue to be brought down (Figure 13) with consensus EPS forecasts discounted a further c. 12% in recent weeks. While semis stocks have historically troughed 2 earnings cut ahead of the last one, given the rapid multiple compression this time, a case could be made that we could be seeing earlier support for stocks in the sector.

Figure 7: Semis YoY 3MMA revs growth (Sell In) vs. the semis SOX index



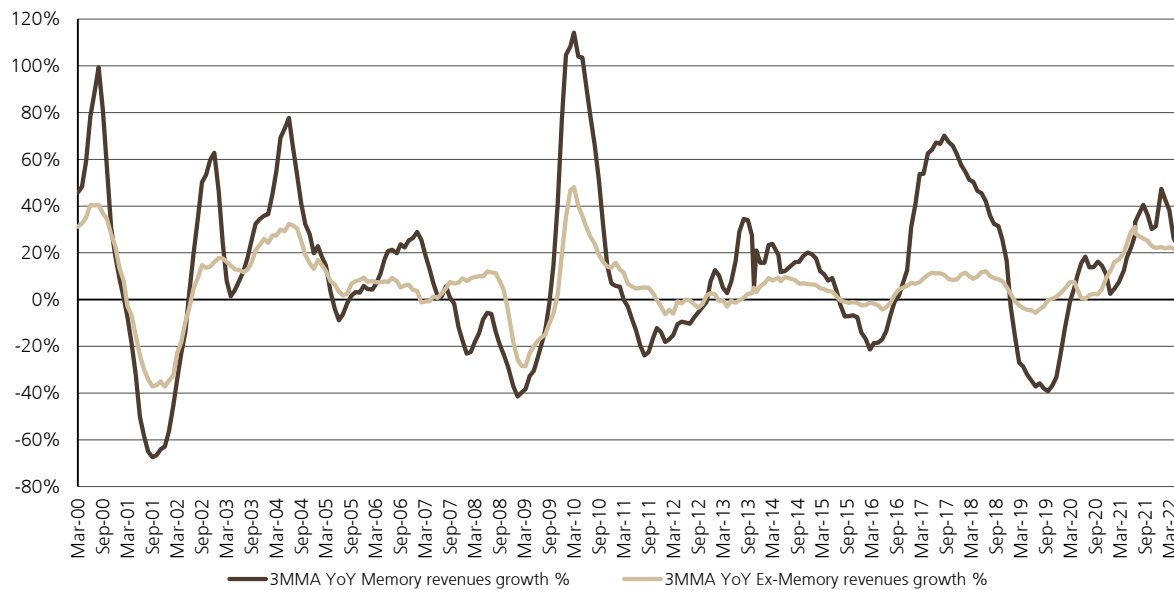
Source: SIA, Bloomberg, UBS estimates

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



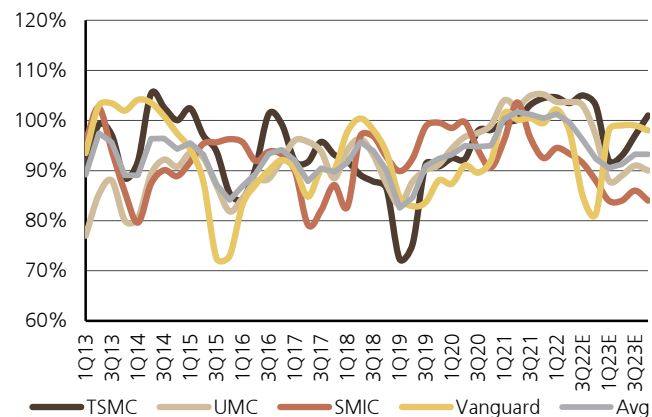
Source: SIA, Bloomberg, UBS estimates

Figure 9: Memory YoY 3MMA revs growth vs. ex-memory semis YoY 3MMA revs growth



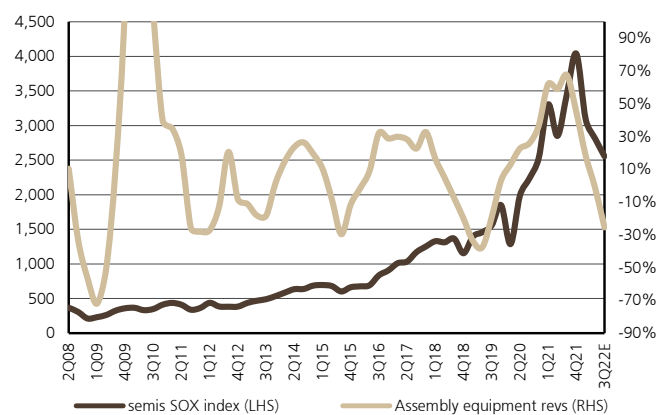
Source: SIA, UBS

Figure 10: Foundry Capacity utilisation rates (1Q13-4Q23E)



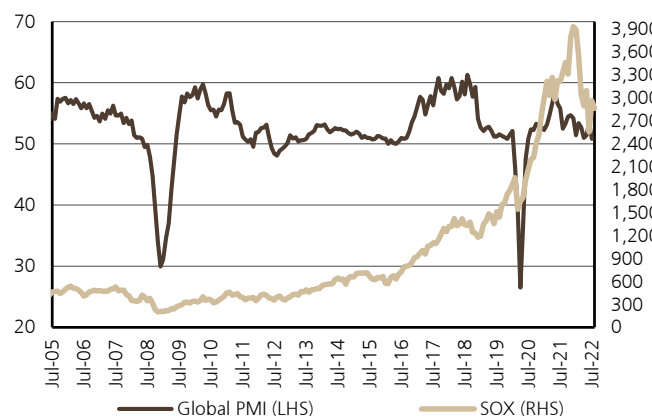
Source: Company data, SEMI, UBS estimates

Figure 11: Assembly equipment revenues growth YoY (%) vs. semis SOX index



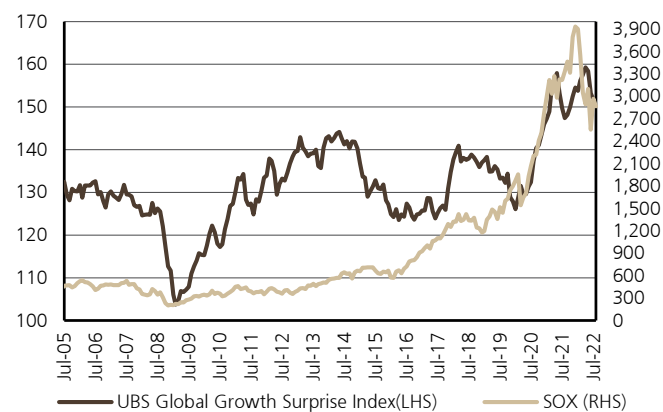
Source: Company data, Bloomberg, UBS estimates. * Companies include KLIC, BE Semis, ASM Pacific Tech (excl SMT) and Disco (Japan).

Figure 12: SOX vs. Global PMI



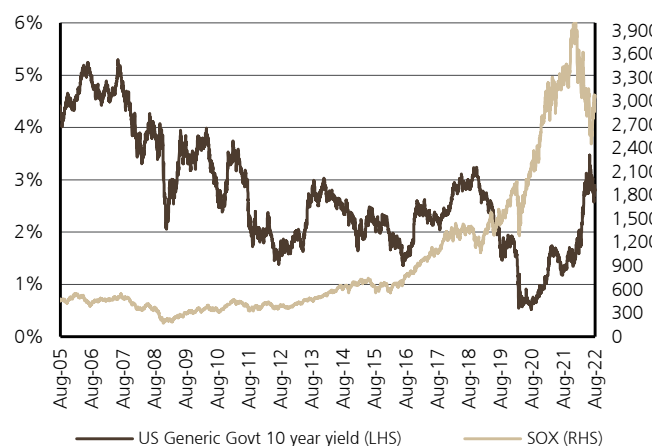
Source: Datastream, UBS estimates

Figure 13: SOX vs. Global Growth Surprise Index



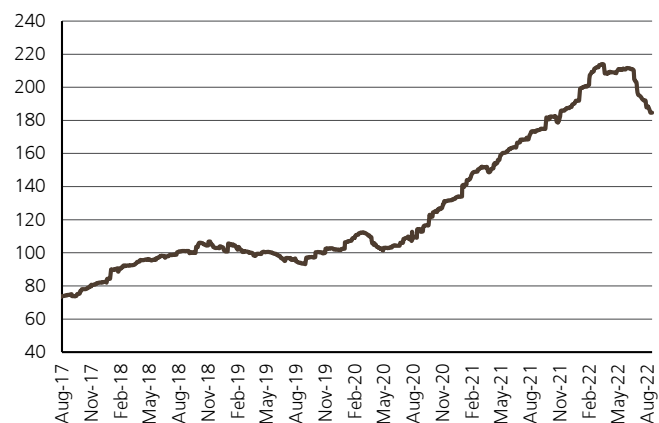
Source: Datastream, UBS estimates

Figure 14: SOX vs. US 10-Y government bond yields



Source: Bloomberg, UBS estimates

Figure 15: SOX 2023E EPS consensus

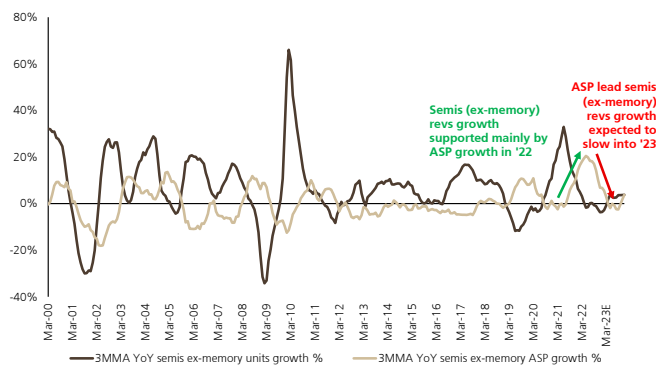


Source: Bloomberg

ASP growth expected to normalize in '23

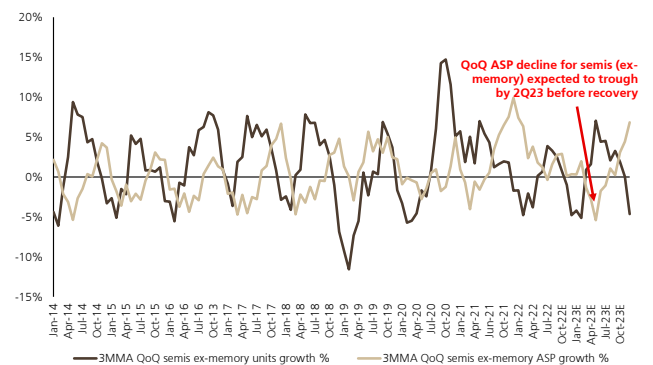
Semis (ex-memory) revenue growth year-to-date in '22 has primarily been supported by a strong pick up in ASP YoY growth (Figure 14) - in fact the highest level of YoY semis ASP growth recorded over the past 20 years at +13% YoY. This has overshadowed the trend that in contrast, semis (ex-memory) unit growth had most recently peaked in 2Q21 and started to decelerate on the back of weaker end-demand and is expected to continue before troughing by 1Q23. Looking into 2023, 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 15). For the FY '23, we forecast non-memory semis ASPs to only grow 1% YoY.

Figure 16: Semis (ex-memory) units & ASP YoY 3MMA growth



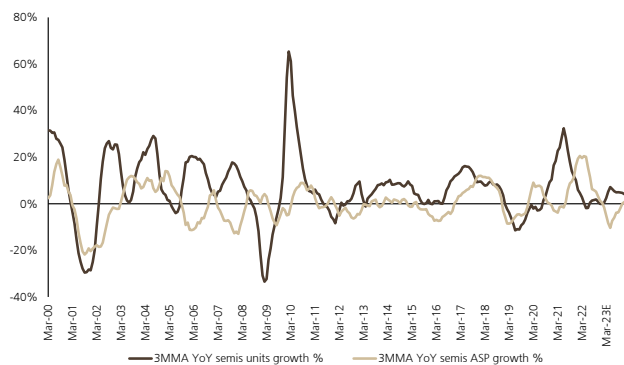
Source: SIA, UBS

Figure 17: Semis (ex-memory) units & ASP QoQ 3MMA growth



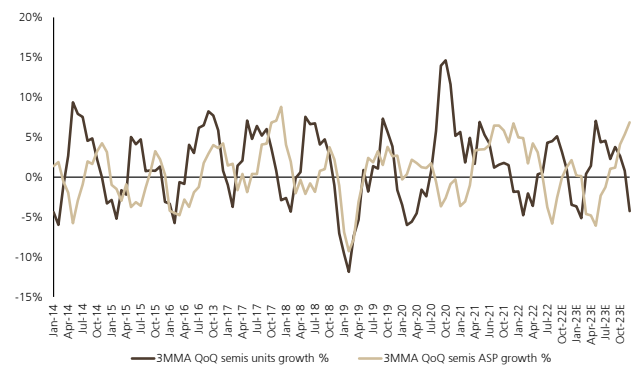
Source: SIA, UBS

Figure 18: Semis units & ASP YoY 3MMA growth



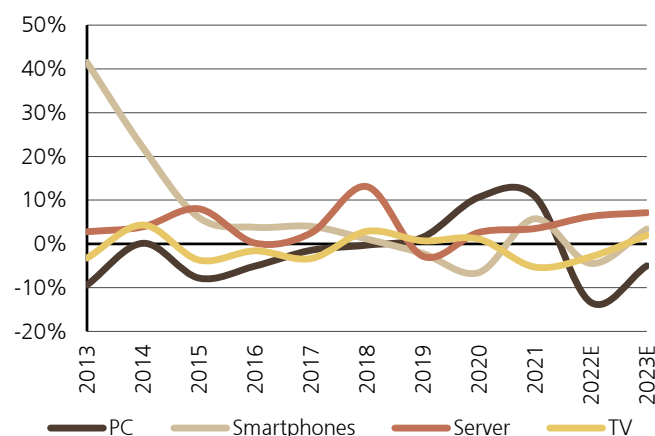
Source: SIA, UBS

Figure 19: Semis units & ASP QoQ 3MMA growth



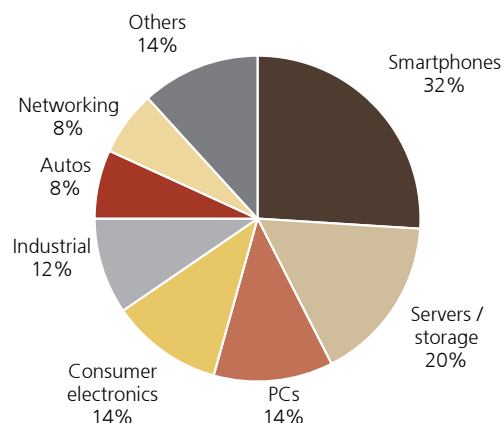
Source: SIA, UBS

Figure 20: YoY shipment devices unit growth by application



Source: UBS estimates

Figure 21: Semis revs breakdown by application (2021)



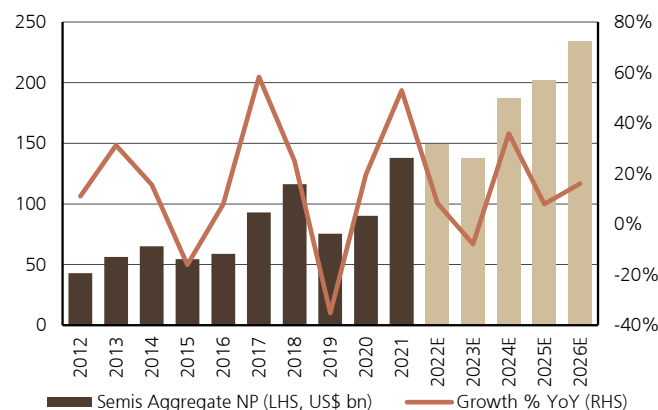
Source: Gartner

Semis earnings YoY growth turning negative in 2023E

As we noted before, semis earnings have historically retained some short-term cyclicity and volatility, in part due to the memory cycle. However, starting from 2013, longer-term growth began to effectively accelerate. When looking at 5-Y forward EPS growth across our whole semis coverage universe, it broke the 10% mark back in 2016, and never went back below it since. **We now forecast global semis EPS CAGR of 12.0% for '21-26E, down from 13.7% back last June ([link](#))**. This compares to '19-24E CAGR of 20.9%.

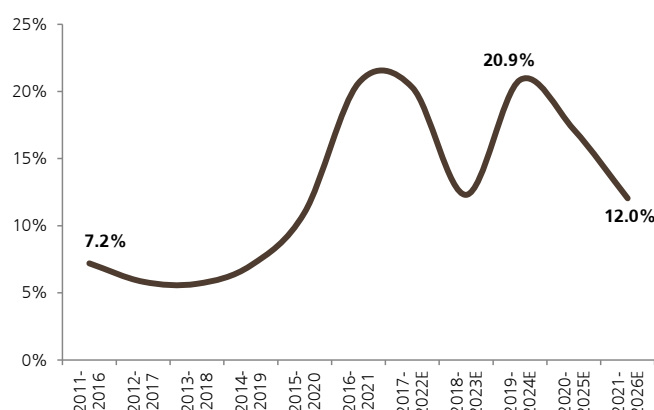
In addition, 1-year forward EPS growth is also coming down from a recent high of 53% in '21, as the sector experienced a strong cyclical recovery post the initial COVID wave. **We now forecast YoY EPS growth to decelerate to 8% in '22E before turning negative to -8% YoY in '23E**. This is the first time our forecast turns negative (last June was +2%) and continues to reflect the likely impact of tepid demand, de-stocking, and normalised pricing. **From '24E onwards we expect YoY EPS growth to re-accelerate to 36%, post trough, as secular demand drivers pick up again.**

Figure 22: Semis aggregate net profits % growth



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

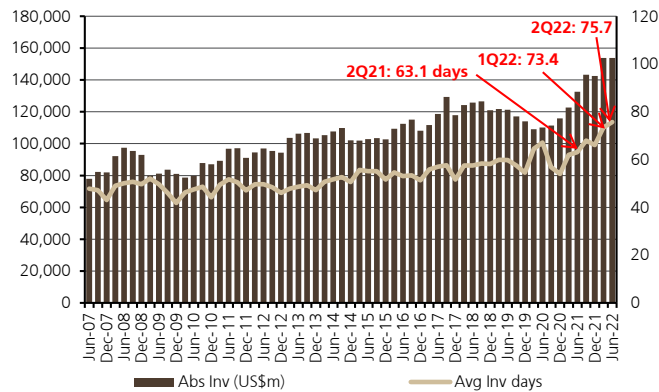
Figure 23: 5-year forward semis EPS CAGR



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

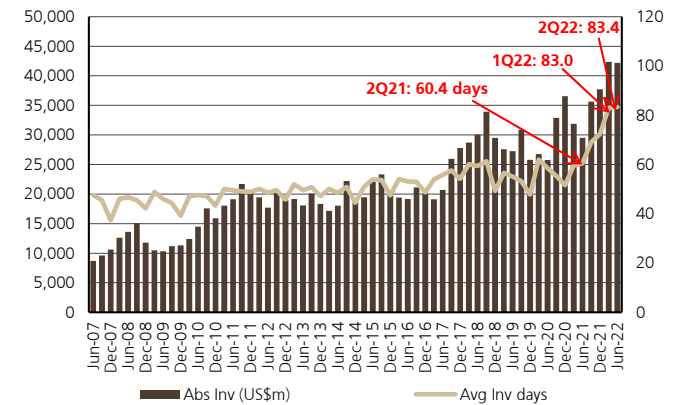
Inventory Analysis

Figure 24: OEMs – Absolute inventory & Inventory days



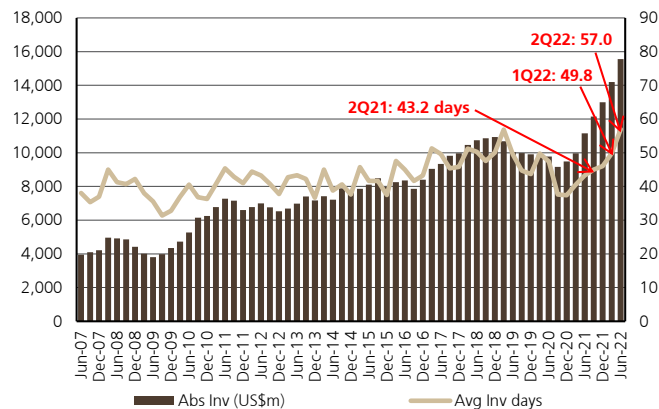
Source: Company data, UBS

Figure 25: EMS – Absolute inventory & Inventory days



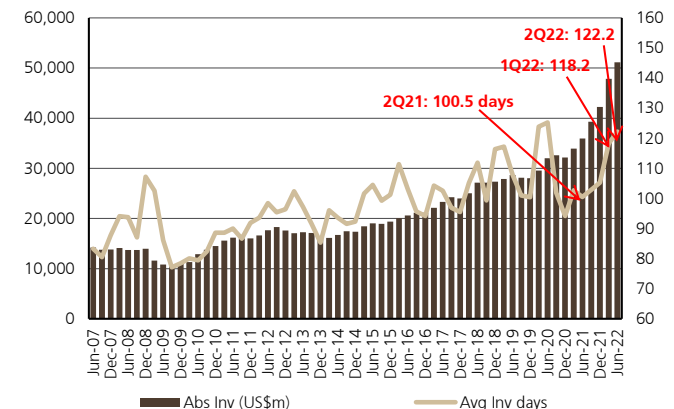
Source: Company data, UBS

Figure 26: Distributors – Absolute inventory & Inv. days



Source: Company data, UBS

Figure 27: Non Memory Semis – Abs. inv. & Inv. days



Source: Company data, UBS

Downstream Inventories

While noticeably slower vs the prev Q, OEM average inventory days continued to increase QoQ while also up YoY to 75.7 days on average (up 2.3 days QoQ and up 12.6 days YoY) trending higher than the historical average of 61.3 days.

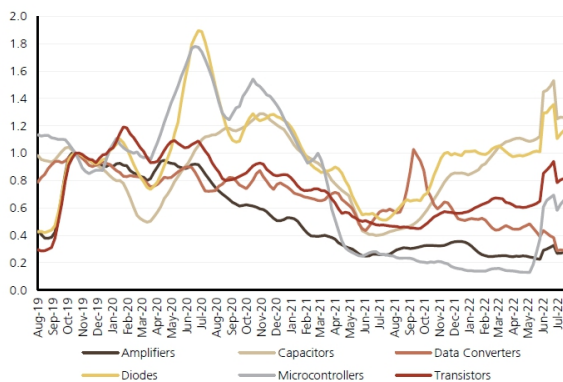
The QoQ and YoY increase was seen across most OEM segments including Mobile Devices, Communication infra, PCs/IT Hardware, Consumer Elec and Autos while only Industrials saw inventory days trended down both QoQ and YoY. Absolute inventory for OEMs on aggregate was relatively flat at 0.1% QoQ but up 16.0% YoY.

- **Mobile Devices:** Apple's inventory days was up 1.4 days QoQ but relatively flat YoY at 10.5 days while Xiaomi saw a noticeable increase in inventory days up both 4.7 days QoQ and 16.8 days YoY to 89.2 days.
- **Communication Infra:** Average inventory days for Communication Infra was up 0.5 days QoQ while up 15.2 days YoY to 75.4 days with absolute inventory also up 6.7% QoQ and 35.3% YoY. Cisco, Juniper and Nokia saw inventory days go up both QoQ and YoY while Ericsson and VIAVI solutions had inventory days down QoQ but up YoY.
- **PCs and IT Hardware:** Average inventory days for PCs/IT Hardware was noticeably up 6.4 days QoQ while also up 25.3 days YoY to 94.9 days, remaining at well elevated levels compared to historical average of 65.4 days. Absolute inventory was down 0.4% QoQ while up 30.5% YoY. Acer, Asustek, Gigabyte, Lenovo, MSI, Nidec and Seagate all had inventory days up both QoQ and YoY. Only Positivo showed inventory days down both QoQ and YoY albeit off a higher base. Dell reported

inventory days down QoQ while up YoY.

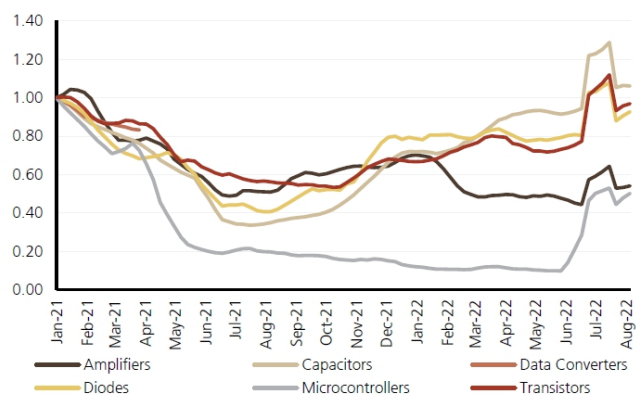
- **Consumer Elec:** Inventory days for Consumer Elec OEMs was also up both QoQ and YoY on average to 88.0 days with absolute inventory also up 1.9% QoQ and 18.5% YoY. Nintendo and Sony both saw inventory days up QoQ and YoY with conversely LGE recording inventory days flat QoQ but up YoY.
- **Autos and Industrial:** Auto inventory days averaged 57.2 days, up 1.9 days QoQ and 5.6 days YoY. Aisin, BorgWarner, Continental, Cummins and Denso all saw inventory days increase both QoQ and YoY with inventory days for Magna down both QoQ and YoY. Hyundai Mobis and Tenneco saw inventory days down QoQ but up YoY while Lear had inventory days up QoQ but down YoY. Inventory days for Industrials on average was at 100.5 days, down 18.2 days QoQ and 6.8 days YoY. ABB, Emerson, GE, Honeywell, Hongfa Tech and Johnson Controls saw inventory days trend down QoQ while up YoY. OPT Machine, Shenzhen Yinghe and Suzhou Maxwell inventory days were down both QoQ and YoY. Conversely, Siemens and Legrand both had inventory days up QoQ and YoY.

Figure 28: Normalised semis components inventory trends at distribution



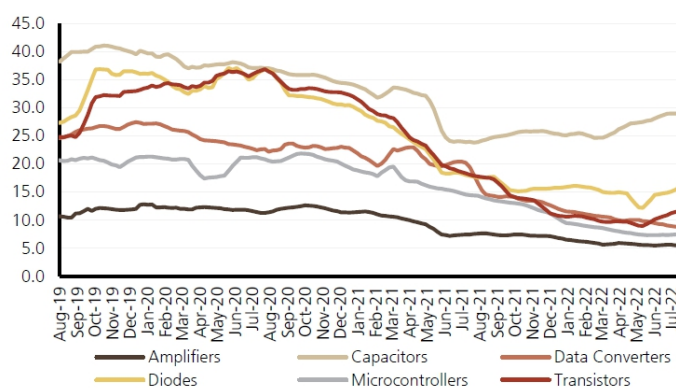
Source: UBS Evidence Lab ([Access Dataset](#))

Figure 29: Recent semis components inventory trends at distribution



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

Figure 30: Semis component products in stock at distribution (%)



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

Upstream Inventories

Average inventory days for non-memory semis was at 122.2 days (up 4.0 days QoQ and also up 21.7 days YoY), still remaining well above historical average of 108.0 days. Absolute inventory similarly was up 6.8% QoQ while also up 42.2% YoY.

- Companies that saw both QoQ and YoY increase in inventory days include Analog Devices, ams, Guoxin Micro, Infineon, Lattice, Marvell, Melexis, Microchip, Novatek, NXP, Qorvo, Qualcomm, Realtek, Renesas, Silergy, Skyworks, STM and Will Semi. Conversely, AMD, Magnachip Semi, SG Micro, 3Peak and Verisilicon saw inventory days down both QoQ and YoY.
- AMLogic, Cambricon, Diodes, Intel, MediaTek, NVIDIA, On Semis, Rockchip, Rohm and Texas Instruments had inventory days down QoQ but up YoY whereas Cirrus Logic and Montage Tech saw inventory days increase QoQ but come down YoY.

Semis revenues vs. end consumption

Figure 31: Semis Sell-Through vs. OEM revenues

	2019	2020	2021	1Q22	2Q22	3Q22E	4Q22E	2022E	1Q23E	2Q23E	3Q23E	4Q23E	2023E
Semis revenues (Sell Through)	356.6	381.8	482.4	132.8	136.5	134.4	137.7	541.4	130.9	134.0	144.1	150.2	559.2
% of total semis industry revs	86.5%	87.0%	86.8%	87.5%	89.5%	86.0%	89.2%	88.0%	88.9%	89.0%	91.1%	92.8%	90.5%
%QoQ				0.4%	2.8%	-1.5%	2.4%		-5.0%	2.4%	7.6%	4.2%	
%YoY	-13.9%	7.1%	26.3%	23.7%	17.5%	6.1%	4.2%	12.2%	-1.4%	-1.8%	7.2%	9.1%	3.3%
Semis revs ex memory (Sell Through)	245.2	269.9	340.4	95.6	96.5	99.1	101.4	392.6	98.4	100.2	107.3	111.3	417.3
%QoQ				1.6%	0.9%	2.7%	2.4%		-2.9%	1.8%	7.0%	3.8%	
%YoY	-1.5%	10.1%	26.1%	22.8%	18.8%	13.6%	7.7%	15.3%	2.9%	3.9%	8.3%	9.7%	6.3%
OEM revenues	1902.1	1731.4	1918.5	492.7	481.4	499.1	562.9	2041.5	520.1	495.9	505.8	570.9	2097.6
%QoQ				-7.0%	-2.3%	3.7%	12.8%		-7.6%	-4.7%	2.0%	12.9%	
%YoY	0.8%	-9.0%	10.8%	5.3%	4.9%	8.2%	6.3%	6.4%	5.6%	3.0%	1.4%	1.4%	2.8%

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

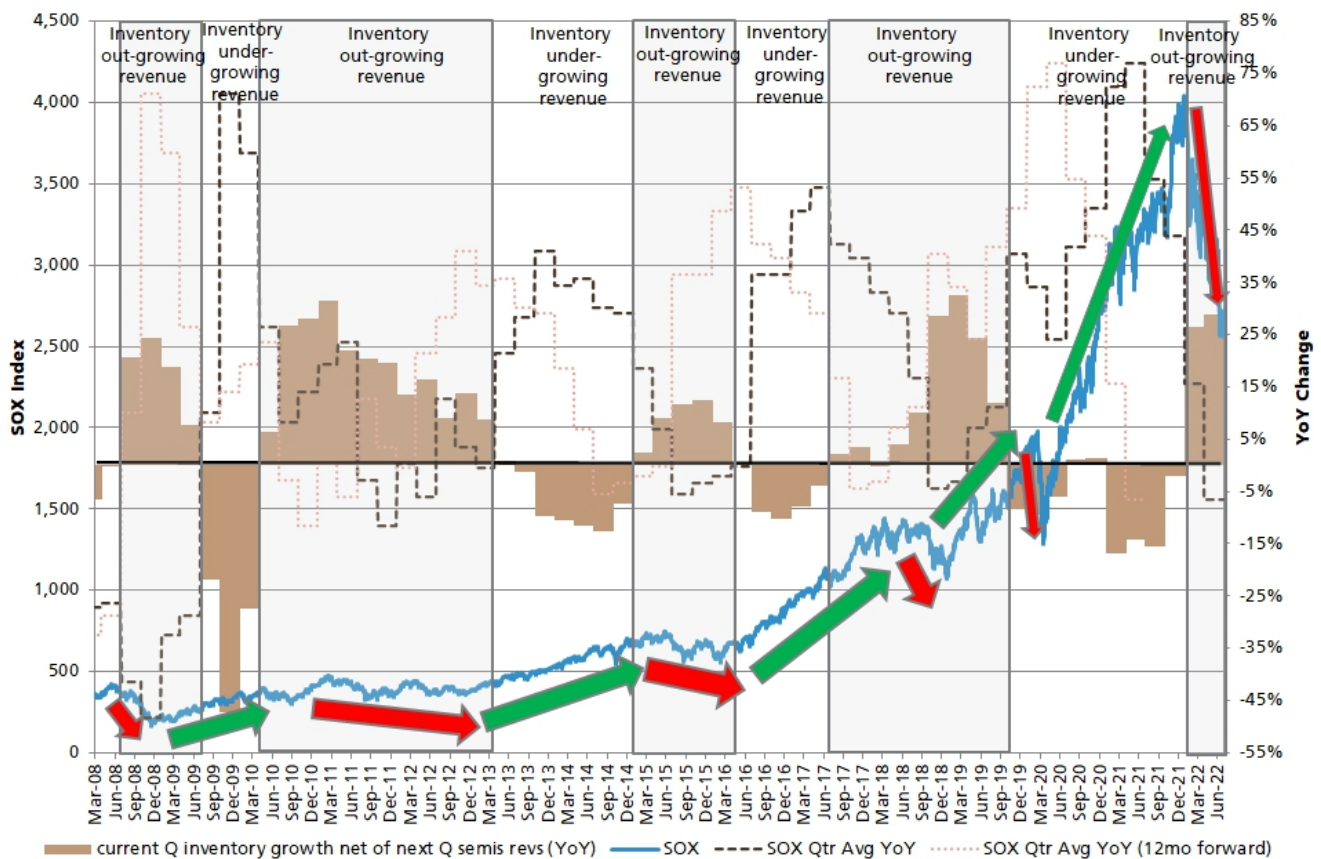
Our proprietary model comparing non-memory semis sell-through and OEM consumption continues to indicate an 8.9 pct pts **over-shipment for semis (non-memory) vs. OEM consumption in 2022, with non-memory semis revenues expected to increase 15.3% YoY vs. OEM revenues up only 6.4% YoY. While this is a noticeable gap, we also note that some of this pertains to ASP accretion.** However, beyond this and entering into 2023, our model suggests both semis revenue growth and OEM revenues will decelerate with the over-shipment delta narrowing to a milder 3.5 pct pts by 2023.

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 couple quarters at least where inventory has continued to OUTGROW forward revenue to a fairly substantial degree. This has historically been an unfavorable backdrop for semis stocks and is typically the harbinger of a cyclical downturn. The pace at which this develops will depend to some degree on how much inventory the supply chain wants to carry post COVID to drive more of a "just-in-case" approach versus the "just-in-time" that has been widely employed.

Figure 32: Inventory Y/Y growth faster than semis Y/Y revenue growth on a 1Q lag basis last couple quarters



Source: Company data, UBS estimates

Semiconductor revenues forecasts

We now forecast overall semis industry (Sell In) revenues of US\$614.9bn for '22E (+10.6% YoY) within which we expect non-memory semis revenue of US\$459.1bn (+14.9% YoY). **Entering '23E, we forecast the period of strong YoY ASP growth that supported 2022 to largely normalize, with overall semis revenues of US \$617.9bn (+0.5% YoY) and semis ex-memory revs growth slowing down to +3.3% YoY.**

Figure 33: Global Semis revenues forecasts by product segments (Sell-In basis)

Revenues (US\$bn)		2015	2016	2017	2018	2019	2020	2021	2022E	2023E
MPU		43.3	43.1	44.4	46.9	48.0	51.8	57.8	60.9	63.6
	% YoY	-1.7%	-0.5%	3.1%	5.7%	2.3%	8.0%	11.5%	5.4%	4.5%
MCU		15.5	16.3	16.4	17.1	15.8	15.5	19.6	23.0	23.2
	% YoY	1.1%	5.0%	1.1%	3.8%	-7.4%	-2.0%	26.7%	17.0%	1.0%
DSP		2.6	2.9	3.3	3.3	2.7	2.4	2.8	3.0	3.0
	% YoY	-6.5%	12.5%	14.5%	-0.6%	-18.6%	-10.4%	19.4%	5.0%	2.0%
Analog		45.2	47.8	53.1	58.8	53.9	55.7	74.1	85.2	86.1
	% YoY	1.9%	5.8%	10.9%	10.8%	-8.3%	3.3%	33.1%	15.0%	1.0%
CMOS Logic		90.8	89.9	102.2	109.3	106.4	118.4	154.8	190.4	200.0
	% YoY	-1.0%	-0.9%	13.7%	6.9%	-2.7%	11.3%	30.8%	23.0%	5.0%
Memory		77.2	76.8	124.0	158.0	106.4	117.5	153.8	155.8	143.5
	% YoY	-2.6%	-0.6%	61.5%	27.4%	-32.6%	10.4%	30.9%	1.3%	-7.9%
Total IC		274.5	276.6	343.3	393.3	333.2	361.2	463.0	518.3	519.3
	% YoY	-0.9%	0.8%	24.1%	14.5%	-15.3%	8.4%	28.2%	11.9%	0.2%
Discrete, Opto & Passives		60.7	62.2	68.7	75.5	78.9	79.2	92.9	96.6	98.5
	% YoY	3.7%	2.5%	10.5%	9.8%	4.6%	0.3%	17.3%	4.0%	2.0%
Total Semiconductors		335.2	338.8	412.1	468.8	412.1	440.4	555.9	614.9	617.9
	% YoY	-0.1%	1.1%	21.6%	13.8%	-12.1%	6.9%	26.2%	10.6%	0.5%
Semis ex memory		258.0	262.1	288.1	310.8	305.7	322.9	402.1	459.1	474.4
	% YoY	0.6%	1.6%	9.9%	7.9%	-1.7%	5.6%	24.5%	14.2%	3.3%
Semis ex memory ex CPU		214.7	219.0	243.7	263.9	257.7	271.1	344.3	398.2	410.8
	% YoY	1.1%	2.0%	11.3%	8.3%	-2.4%	5.2%	27.0%	15.7%	3.2%

Source: Company data, SIA, UBS estimates

A different perspective to forecasting semis units

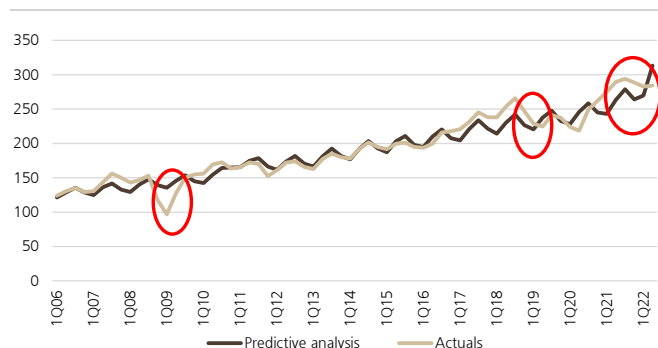
Investors understand well that **semis revenues are closely influenced by the macroeconomic outlook**. So in order to better assess the influence of those variables onto semis revenues, in collaboration with UBS's New Analytic Approaches team, we developed a statistical model to test whether/how macro indicators including world GDP and PMI could be used as reliable 'yardsticks' to predict worldwide semis units sell-in.

With a multivariate linear regression, we quantified the **relationship between A) worldwide semis unit sell-in actual to B) near-historical world real GDP and US PMI numbers**. By doing so, we were able to derive a predictive model for semis units yielding a ~2% forecasting error during its validation period (2017-21); a useful tool for us to fall back on and reference when adjusting our forecasts going forward.

Comparing historical actuals to the implied units yielded by the predictive model does show a close correlation between the two over time; however, there are also noticeable instances where the relationship did break down, resulting in a higher than usual delta between the two data sets. One instance can be seen right after the 2008 financial crisis where the predictive model overestimated semis units failing to account for the recession, another in '17-18 underestimating semis units sell-in and most recently in '21.

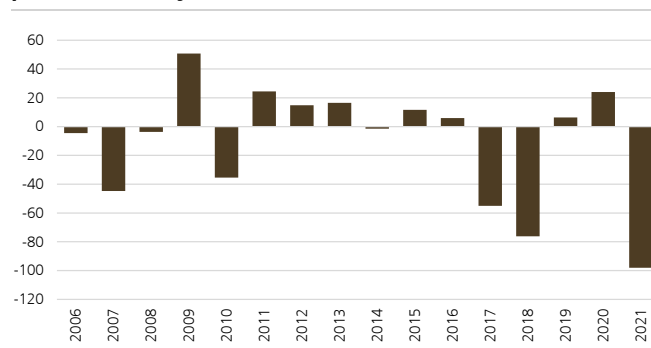
Hence, while under normalized circumstances the predictive model does fare well in predicting semis units sell-in, the case could be made that results will be prone to drift in times of economic volatility. Top down, analysis of **the semis unit trend predictive model indicates quarterly volumes continues to be directionally in line with our estimates** for both 2022/23, suggesting a slowdown in units sell-in by 2H22/1H23 before a recovery throughout 2023. **On a YoY basis, the model continues to indicate some compression in volumes YoY for '23, vs our estimates suggesting YoY units growth to trough slightly earlier in 2H22 before recovering in '23**. Both data sets however similarly reflect macroeconomic drivers are a key risk of downside to semis unit growth near term.

Figure 34: WW semis units sell-in; predictive analysis vs. actual (bn units)



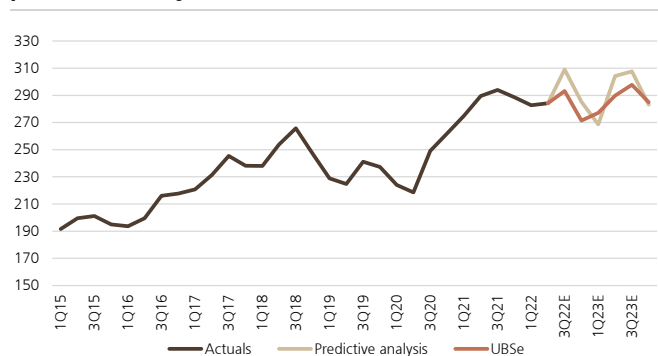
Source: SIA, UBS estimates

Figure 35: Net difference in predicted semis units sell-in; predictive analysis vs. actual (bn units)



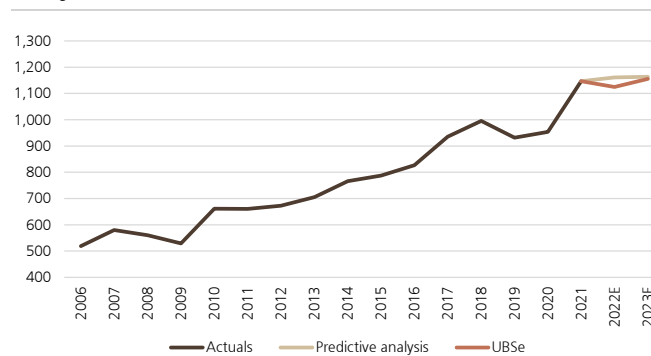
Source: SIA, UBS estimates

Figure 36: Forecasted quarterly semis units sell-in; predictive analysis vs. UBSe (bn units)



Source: SIA, UBS estimates

Figure 37: Forecasted annual semis units sell-in; predictive analysis vs. UBSe (bn units)



Source: SIA, UBS estimates

Appendix: Industry Inventories

Figure 38: Inventory days – OEMs

	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22
Mobile Devices									
Apple	9.8	9.3	6.8	9.2	10.2	12.5	7.7	9.1	10.5
Xiaomi	77.4	51.5	64.3	72.8	72.3	84.3	69.1	84.5	89.2
Mobile Devices. - Average	43.6	30.4	35.5	41.0	41.3	48.4	38.4	46.8	49.9
Communication Infra									
Cisco	26.2	27.3	31.4	31.2	29.8	34.5	40.2	43.2	46.4
Ericsson	84.8	91.5	62.0	100.8	92.9	101.9	78.0	118.6	116.4
Juniper	24.2	33.4	31.7	51.6	39.4	41.0	45.2	55.8	62.6
Nokia	93.4	87.8	66.1	79.4	71.2	69.4	56.8	75.9	76.6
VIAVI Solutions	67.9	69.1	67.1	68.0	67.8	73.3	84.0	80.9	74.9
ZTE	201.7	212.9	185.5	220.1	224.2	215.1	190.1	262.5	
Comm Infra - Average	59.3	61.8	51.7	66.2	60.2	64.0	60.8	74.9	75.4
PCs/IT Hardware/HDDs									
Acer	56.3	48.0	53.7	73.6	77.8	76.1	71.7	83.8	89.1
Asustek	104.4	79.4	88.5	116.1	127.4	140.7	128.8	166.6	178.8
Dell Technologies	21.2	19.2	17.3	20.2	21.3	24.4	24.1	28.2	25.7
Gigabyte	68.6	71.6	72.1	85.9	89.1	87.1	106.0	121.8	138.7
HPQ	45.2	43.3	49.3	55.0	62.6	54.0	60.3	62.0	
HPE	66.7	48.8	56.0	64.6	79.7	83.4	105.2	107.0	
Inspur	66.4	92.2	64.7	101.5	78.2	115.7	109.1	132.9	
Lenovo	41.4	39.0	36.5	45.0	50.6	53.6	45.9	54.8	57.4
MSI	48.1	46.5	41.1	53.0	50.1	51.9	63.2	83.9	85.0
Nidec	97.9	76.2	75.0	84.7	89.0	93.3	94.0	101.3	108.1
Positivo	137.7	150.9	86.6	174.4	205.6	257.8	212.1	212.5	108.5
Seagate	56.3	70.3	62.4	58.7	51.6	50.2	54.2	67.6	76.4
PC - OEM Average	61.8	56.3	55.8	67.1	69.6	72.2	73.5	88.5	94.9
Consumer Elec									
Hisense	32.0	28.8	38.6	50.6	44.6	42.8	53.4	49.2	
LG Elec	21.6	20.2	17.7	20.9	22.5	24.1	20.3	22.8	22.7
Nintendo	59.4	67.6	25.0	54.1	111.6	203.5	45.0	114.2	181.8
Skyworth	131.8	130.7	171.9	150.0	120.5	109.6	128.7	151.2	
Sony	37.0	42.2	28.6	35.6	42.7	46.1	31.6	47.6	59.4
TCL Electronics	31.1	47.2	50.1	60.6	89.4	75.0	74.9		
CE - OEM Average	39.3	43.3	23.7	36.9	58.9	91.3	32.3	61.6	88.0
Autos									
Aisin	56.1	40.8	36.5	42.4	43.0	54.3	51.9	55.7	58.7
BorgWarner	60.9	36.9	37.2	38.9	47.7	54.4	46.2	48.0	49.5
Continental	78.8	52.9	46.6	60.4	67.2	72.0	63.3	70.4	75.9
Cummins	112.6	84.0	69.9	74.4	80.3	86.6	87.7	86.2	89.5
Denso	83.3	53.8	51.4	58.6	63.1	78.0	69.2	72.9	78.9
Hyundai Mobis	44.8	33.0	30.4	36.4	37.8	40.4	36.8	42.2	40.7
Lear	44.2	25.9	26.7	27.5	33.3	39.9	31.1	30.7	31.1
Magna	76.0	41.7	35.9	38.4	47.2	55.0	46.3	46.3	44.9
Tenneco	60.5	42.4	40.2	41.1	44.1	45.7	43.7	45.5	45.4
Auto - Average	68.6	45.7	41.6	46.5	51.5	58.5	52.9	55.3	57.2
Industrials									
ABB	96.2	89.2	82.6	88.4	86.8	94.0	86.7	104.7	102.9
AVIC Jonhon	102.7	115.6	154.8	142.6	159.6	188.5	220.8	191.6	
Emerson	83.5	65.7	75.3	71.6	71.1	63.4	80.4	77.1	72.8
Estun Automation	162.8	196.2	150.8	158.8	112.2	159.4	153.5	148.3	
General Electric	85.4	83.1	83.3	112.7	108.2	114.3	96.8	116.7	116.1
Guangzhou Haige Comms	190.8	294.0	138.7	345.0	206.5	282.4	149.3	300.5	
Honeywell	82.2	81.1	68.5	73.6	71.8	78.9	79.0	88.0	84.2
Hongfa Technology	102.7	101.0	84.9	92.6	92.9	116.3	141.4	115.6	113.2
Johnson Controls	51.9	40.7	48.3	49.8	45.4	44.7	55.7	55.4	53.2
Legrand	122.6	95.3	101.0	106.2	105.7	119.2	122.6	123.5	125.0
OPT Machine	121.3	127.3	150.3	165.0	192.3	144.8	187.4	211.1	151.0
Shenzhen Yinghe Technology	185.0	164.1	149.2	332.9	216.8	199.1	147.6	213.7	103.8
Siemens	83.4	70.5	80.7	78.9	81.9	72.4	84.3	81.7	83.3
Suzhou Maxwell	517.2	391.2	423.0	597.4	734.8	441.2	465.8	602.0	589.3
Zoomlion	86.1	113.7	94.5	112.0	85.9	155.3	124.9	186.7	
Industrials - Avg	101.4	91.8	92.4	117.2	107.3	104.7	108.2	118.7	100.5
OEM AVERAGE	67.1	56.8	54.0	62.0	63.1	67.9	66.1	73.4	75.7
OEM Avg. ex Auto, Indust.	55.5	52.2	48.8	59.6	59.7	63.3	59.8	72.6	77.1

Source: Company data, UBS. *Note: Average calculations only inclusive of companies that have reported 2Q22 earnings.

Figure 39: Absolute Inventories – OEMs

(USD mn)	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22
Mobile Devices									
Apple	3,978	4,061	4,973	5,219	5,178	6,580	5,876	5,460	5,433
Xiaomi	5,481	5,057	6,391	7,645	8,793	8,992	8,200	8,738	8,628
Agg. - Mobile Devices	9,459	9,118	11,364	12,864	13,971	15,572	14,076	14,198	14,061
QoQ%	15.1%	-3.6%	24.6%	13.2%	8.6%	11.5%	-9.6%	0.9%	-1.0%
YoY%	30.2%	16.2%	30.3%	56.5%	47.7%	70.8%	23.9%	10.4%	0.6%
Communication Infra									
Cisco	1,282	1,303	1,436	1,579	1,559	1,832	2,059	2,231	2,568
Ericsson	3,294	3,698	3,426	3,596	3,624	4,026	3,969	4,693	4,681
Juniper	124	176	176	259	212	223	272	317	395
Nokia	3,148	3,192	2,772	2,730	2,392	2,428	2,392	2,636	2,910
VIAVI Solutions	83	87	88	91	95	103	114	114	110
ZTE	5,244	5,687	5,167	5,260	5,359	5,784	5,684	6,423	
Agg. - Infra OEMs	7,931	8,456	7,898	8,255	7,882	8,612	8,806	9,991	10,664
QoQ%	0.6%	6.6%	-6.6%	4.5%	-4.5%	9.3%	2.3%	13.4%	6.7%
YoY%	-16.1%	-9.5%	-1.3%	4.7%	-0.6%	1.8%	11.5%	21.0%	35.3%
PCs/IT Hardware/HDDs									
Acer	1,206	1,282	1,519	1,787	2,098	2,097	2,109	2,284	2,133
Asustek	2,922	2,912	3,438	4,032	4,626	5,726	6,012	7,310	7,305
Dell Technologies	3,602	3,393	3,402	3,828	4,223	5,442	5,898	6,277	5,883
Gigabyte	437	507	538	710	797	804	955	1,181	1,007
HPQ (HP Inc)	5,896	5,963	6,668	7,502	8,165	7,930	9,018	8,944	
HPE	3,469	2,674	2,791	3,117	3,942	4,511	5,321	5,322	
Inspur	1,312	1,978	1,678	1,731	1,902	2,989	3,506	3,479	
Lenovo	5,127	5,243	5,785	6,381	7,825	8,727	8,441	8,301	8,868
MSI	449	489	508	530	559	604	788	952	1,071
Nidec	2,629	2,529	2,647	2,798	3,063	3,361	3,636	4,080	3,939
Positivo	100	124	124	150	198	269	303	359	316
Seagate	1,142	1,323	1,318	1,281	1,204	1,188	1,287	1,479	1,565
Agg. - PC OEMs	17,614	17,802	19,280	21,497	24,594	28,217	29,430	32,223	32,087
QoQ%	2.8%	1.1%	8.3%	11.5%	14.4%	14.7%	4.3%	9.5%	-0.4%
YoY%	18.3%	14.7%	21.8%	25.5%	39.6%	58.5%	52.6%	49.9%	30.5%
Consumer Elec									
Hisense	505	473	659	935	972	989	1,320	1,251	
LG Elec	1,164	1,418	1,437	1,543	1,607	1,921	1,882	1,971	1,869
Nintendo	887	1,319	796	819	1,434	2,453	1,490	1,821	1,887
Skyworth	1,564	1,537	2,003	2,468	2,561	2,475	2,682	2,888	
Sony	5,466	6,423	5,863	6,012	6,925	7,703	6,938	7,796	8,057
TCL Electronics	613	1,120	1,120	1,292	1,802	1,743	1,740		
Agg. - CE OEMs	7,518	9,160	8,097	8,373	9,966	12,077	10,310	11,588	11,813
QoQ%	1.0%	21.8%	-11.6%	3.4%	19.0%	21.2%	-14.6%	12.4%	1.9%
YoY%	-13.7%	-3.0%	6.0%	12.5%	32.6%	31.8%	27.3%	38.4%	18.5%
Autos									
Aisin	3,346	3,356	3,424	3,583	3,648	4,282	4,546	5,074	4,534
BorgWarner	836	815	1,286	1,361	1,567	1,649	1,534	1,644	1,653
Continental	5,325	5,148	5,232	4,996	5,480	5,808	5,740	6,472	6,600
Cummins	3,655	3,470	3,425	3,753	4,076	4,322	4,355	4,586	4,765
Denso	6,596	6,304	6,454	6,850	7,153	8,165	8,346	9,207	8,275
Hyundai Mobis	2,692	2,647	2,815	3,037	3,282	3,411	3,613	4,000	3,867
Lear	1,245	1,266	1,401	1,465	1,590	1,766	1,572	1,642	1,613
Magna	3,503	3,509	3,444	3,645	3,999	4,150	3,969	4,258	4,064
Tenneco	1,656	1,678	1,743	1,830	1,920	1,893	1,846	2,049	2,073
Agg. - Autos OEMs	28,854	28,193	29,224	30,520	32,715	35,446	35,521	38,932	37,445
QoQ%	-0.8%	-2.3%	3.7%	4.4%	7.2%	8.3%	0.2%	9.6%	-3.8%
YoY%	1.4%	-2.8%	4.9%	4.9%	13.4%	25.7%	21.5%	27.6%	14.5%
Industrial									
ABB	4,395	4,642	4,469	4,475	4,700	4,864	4,880	5,372	5,595
AVIC Jonhon	304	318	428	473	559	639	740	781	
Emerson	2,102	1,928	2,013	2,016	2,114	2,050	2,335	2,399	2,319
Estun Automation	111	116	98	111	118	130	133	137	
General Electric	15,251	14,925	15,890	16,530	17,016	16,790	15,847	16,570	17,553
Guangzhou Haiqe Comms	249	285	286	328	330	335	299	311	
Honeywell	4,753	4,705	4,489	4,607	4,723	4,967	5,138	5,472	5,576
Hongfa Technology	199	193	228	236	266	325	391	377	379
Johnson Controls	1,996	1,773	1,913	1,994	2,064	2,057	2,425	2,515	2,574
Legrand	967	959	1,034	1,085	988	1,125	1,252	1,345	1,460
OPT Machine	9	10	11	16	22	22	24	27	29
Shenzhen Yinghe Technology	113	110	131	222	331	391	390	470	420
Siemens	8,691	9,064	9,559	9,586	10,790	10,395	11,192	11,767	11,308
Suzhou Maxwell	272	271	322	390	456	432	439	509	546
Zoomlion	1,873	2,158	2,247	2,601	2,581	2,427	2,113	2,549	
Agg. Industrial*	38,747	38,581	40,059	41,156	43,470	43,418	44,313	46,823	47,758
QoQ%	-1.5%	-0.4%	3.8%	2.7%	5.6%	-0.1%	2.1%	5.7%	2.0%
YoY%	-26.2%	-16.0%	-12.7%	4.7%	12.2%	12.5%	10.6%	13.8%	9.9%
AGGREGATE OEMs	110,123	111,310	115,922	122,665	132,596	143,343	142,457	153,756	153,828
QoQ%	0.9%	1.1%	4.1%	5.8%	8.1%	8.1%	-0.6%	7.9%	0.0%
YoY%	-9.2%	-4.9%	1.7%	12.4%	20.4%	28.8%	22.9%	25.3%	16.0%

Source: Company data, UBS

Figure 40: Inventory days – ODM, EMS, LCD, Retailers & Distributors

	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22
PC ODMs									
Compal Elec	30.9	36.7	27.3	32.4	43.8	37.4	30.3	48.1	52.4
Inventec	34.3	30.5	31.4	39.2	44.9	46.3	41.2	56.8	52.9
Pegatron	34.8	35.2	34.1	65.2	51.2	47.9	31.8	53.5	58.2
Quanta	56.4	67.2	47.9	59.4	62.9	73.4	57.8	79.8	89.0
Wistron	46.0	48.2	39.5	61.6	56.5	64.5	60.9	77.6	74.1
PC ODM - Average	40.5	43.5	36.0	51.6	51.9	53.9	44.4	63.2	65.3
EMS									
Celestica	79.6	77.1	78.3	92.9	85.8	95.5	113.0	123.1	122.7
Flextronics	65.7	59.2	54.3	61.7	69.1	81.9	88.7	94.6	97.0
Hon Hai	43.4	53.3	37.7	46.2	38.9	46.7	35.4	52.0	48.0
Jabil Circuits	51.0	42.0	41.5	51.9	54.6	59.0	54.1	70.9	70.8
Sanmina	52.9	45.6	46.3	46.1	53.5	62.5	70.3	74.6	78.3
EMS - Average	58.5	55.4	51.6	59.7	60.4	69.1	72.3	83.0	83.4
TFT-LCD									
AUO	39.4	37.3	36.5	38.1	39.7	45.3	42.8	49.4	55.0
BOE- China	52.7	44.7	67.0	53.1	57.3	70.8	58.7	70.2	
Innolux	49.7	42.9	45.3	45.2	52.3	55.2	52.8	61.8	74.4
LGD	35.9	37.2	32.6	41.6	45.5	53.9	39.0	68.3	79.1
Sharp	63.1	48.4	43.8	50.9	53.7	57.1	49.9	59.9	70.2
TFT-LCD Average	47.0	41.5	39.6	44.0	47.8	52.9	46.1	59.8	69.7
Retailers									
Best-Buy	49.4	75.1	38.2	58.5	64.8	85.7	41.7	68.9	
Office Depot	52.6	50.7	47.4	46.3	48.1	45.8	48.7	46.6	55.1
Suning	41.4	41.7	31.2	42.4	29.7	61.2	42.4	60.8	
Retailer - Average	52.6	50.7	47.4	46.3	48.1	45.8	48.7	46.6	55.1
Distributors									
Arrow	53.3	45.8	39.8	40.1	43.9	47.1	49.0	53.9	54.2
Avnet	67.7	63.9	61.8	57.9	64.5	60.8	62.7	59.2	69.2
Edom Technology	33.3	21.0	22.0	32.0	37.1	37.2	38.7	42.5	53.9
Synnex Technology Intl	38.4	26.0	29.5	33.1	33.1	36.0	37.6	48.5	51.5
WPG Holdings	44.3	31.6	34.0	39.4	37.6	44.0	42.0	45.0	56.1
Distributor - Average	47.4	37.6	37.4	40.5	43.2	45.0	46.0	49.8	57.0

Source: Company data, UBS

Figure 41: Absolute Inventories – ODM, EMS, LCD, Retailers & Distributors

(USD mn)		Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22
PC ODMs										
Compal Elec		2,893	3,559	3,398	3,240	4,242	4,690	4,133	4,871	4,992
Inventec		1,793	1,587	1,463	1,609	1,893	2,473	2,243	2,741	2,557
Pegatron		3,996	4,216	5,835	5,192	5,143	5,724	5,320	6,557	5,824
Quanta		5,232	5,460	5,273	5,751	5,871	6,874	7,064	8,937	8,552
Wistron		3,511	3,696	3,359	3,949	4,094	5,142	5,799	6,500	6,279
Agg. PC ODMs		17,426	18,518	19,328	19,740	21,243	24,903	24,559	29,607	28,203
	QoQ%	1.1%	6.3%	4.4%	2.1%	7.6%	17.2%	-1.4%	20.6%	-4.7%
	YoY%	12.2%	5.4%	37.1%	14.5%	21.9%	34.5%	27.1%	50.0%	32.8%
EMS										
Celestica		1,206	1,205	1,091	1,153	1,224	1,405	1,697	1,935	2,108
Flextronics		3,484	3,611	3,699	3,895	4,444	5,168	5,958	6,580	7,243
Hon Hai		16,880	24,073	27,680	22,493	18,986	23,633	24,152	26,991	25,247
Jabil Circuits		3,284	3,131	3,271	3,559	3,979	4,414	4,681	5,395	5,981
Sanmina		884	861	820	785	892	1,037	1,242	1,438	1,591
Agg. EMS		25,737	32,881	36,560	31,886	29,525	35,656	37,730	42,339	42,170
	QoQ%	-3.8%	27.8%	11.2%	-12.8%	-7.4%	20.8%	5.8%	12.2%	-0.4%
	YoY%	-5.6%	6.7%	41.9%	19.2%	14.7%	8.4%	3.2%	32.8%	42.8%
TFT-LCD										
AUO		891	909	945	948	1,039	1,246	1,239	1,352	1,252
BOE		2,370	2,350	2,742	3,169	3,648	4,410	4,339	4,749	
CMI (Innolux)		1,184	1,082	1,091	1,080	1,254	1,405	1,375	1,486	1,584
LGD		1,671	2,021	1,999	2,278	2,429	3,089	2,831	3,636	3,667
Sharp		2,802	2,592	2,600	2,482	2,694	2,831	2,785	2,768	2,794
Agg. LCD		6,548	6,605	6,634	6,788	7,415	8,571	8,231	9,242	9,296
	QoQ%	-2.9%	0.9%	0.4%	2.3%	9.2%	15.6%	-4.0%	12.3%	0.6%
	YoY%	-1.2%	-1.2%	6.1%	0.7%	13.2%	29.8%	24.1%	36.2%	25.4%
Retailers										
Best-Buy		4,136	7,459	5,612	5,721	6,417	8,553	5,965	6,258	
ODP Hold Co		1,005	1,000	930	929	957	841	859	866	968
Suning		3,318	3,500	3,719	3,285	1,846	1,969	1,923	1,632	
Agg. Retailers		1,005	1,000	930	929	957	841	859	866	968
	QoQ%	8.2%	-0.5%	-7.0%	-0.1%	3.0%	-12.1%	2.1%	0.8%	11.8%
	YoY%	-9.7%	-2.4%	-9.9%	0.0%	-4.8%	-15.9%	-7.6%	-6.8%	1.1%
Distributors										
Arrow		3,420	3,235	3,287	3,275	3,636	3,835	4,202	4,645	4,887
Avnet		2,732	2,944	2,816	2,760	3,236	3,283	3,542	3,681	4,244
Edom Technology		274	229	278	292	322	407	446	469	530
Synnex Technology Intl		1,018	832	1,091	1,052	1,177	1,342	1,714	1,836	1,900
WPG Holdings		2,338	1,929	2,018	2,583	2,776	3,279	3,098	3,558	3,997
Aggregate		9,783	9,169	9,490	9,963	11,147	12,146	13,003	14,189	15,557
	QoQ%	-1.3%	-6.3%	3.5%	5.0%	11.9%	9.0%	7.1%	9.1%	9.6%
	YoY%	-2.5%	-8.2%	-4.2%	0.5%	13.9%	32.5%	37.0%	42.4%	39.6%

Source: Company data, UBS

Figure 42: Inventory days – Non-Memory Semiconductors

	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22
Non-Memory Semis									
AMD	111.5	75.0	71.2	81.5	79.7	77.9	74.3	74.5	70.5
AMLogic	90.8	37.6	48.8	56.9	86.6	109.5	117.1	138.5	108.3
Analog Devices	115.6	121.0	120.5	120.9	120.1	161.1	117.8	128.0	136.2
Austriamicrosystems	80.3	84.6	74.6	93.6	79.8	86.2	101.2	100.4	107.8
Broadcom (Avago)	64.2	52.4	48.0	54.0	61.3	61.7	72.2	77.8	
Cirrus Logic	158.0	114.1	55.3	109.1	128.1	74.6	52.4	54.6	83.3
Diodes Incorporated	124.7	119.7	123.4	96.4	98.9	101.3	109.9	118.3	115.1
GigaDevice	164.4	71.7	71.3	79.7	89.4	79.8	132.3	139.1	
Goodix	91.6	62.9	78.2	77.2	89.7	138.2	111.3	246.2	
Guoxin Micro	211.5	197.8	161.1	209.2	174.2	207.1	177.7	249.6	292.9
Ingenic	635.2	198.4	178.9	158.4	140.7	135.0	147.3	164.6	
Infineon	127.4	110.3	108.4	104.8	115.8	112.5	111.9	123.2	124.0
Intel	88.8	98.5	89.1	96.5	102.2	112.4	108.8	119.6	114.1
Lattice	123.4	133.4	139.4	120.4	122.9	122.8	121.7	131.8	138.9
Magnachip Semiconductor	47.9	31.9	34.2	30.9	47.3	44.0	50.1	51.7	45.6
Marvell	64.7	67.0	65.0	118.6	59.6	92.0	100.1	109.5	114.0
Maxscend	190.3	76.8	158.0	131.6	162.3	230.4	279.1	226.4	
Mediatek	87.9	52.2	64.2	87.8	86.9	92.0	103.9	115.0	104.6
Melexis	219.9	152.3	119.1	106.3	130.5	133.1	137.9	141.4	145.3
Microchip	117.3	120.2	119.2	112.3	111.1	112.0	116.0	125.0	127.3
Montage Tech	107.3	162.8	154.4	172.4	159.0	50.0	67.5	72.3	102.1
Novatek	69.7	48.6	52.3	60.2	59.4	62.2	74.8	82.9	103.3
Nvidia	96.2	82.2	95.0	93.7	91.2	82.4	92.9	101.0	93.7
NXP	119.7	84.9	78.5	79.5	86.7	85.4	82.6	89.3	94.9
ON Semiconductor	139.7	133.4	120.4	123.0	116.0	118.6	124.1	138.8	136.1
Qorvo	103.5	76.5	78.5	85.2	92.2	86.1	115.0	116.0	117.2
Qualcomm	102.9	85.7	68.0	72.2	84.0	74.1	81.9	89.4	102.7
Realtek	82.3	55.3	62.5	70.0	94.9	105.7	120.0	112.0	117.6
Renesas	106.0	93.8	80.6	77.9	77.2	100.5	78.7	94.6	95.2
Rockchip	112.5	71.2	62.7	72.0	57.3	98.6	107.7	176.2	174.1
Rohm	198.4	181.4	168.9	198.3	154.3	167.0	170.1	200.0	184.3
SGMicro	195.2	107.2	125.3	136.5	124.2	135.9	124.0	122.3	115.1
Silergy	140.1	120.2	92.9	101.2	85.3	89.4	92.1	101.8	102.8
Skyworks	158.2	150.9	87.6	113.8	132.3	115.8	96.2	121.3	154.9
Starpower	106.7	133.2	111.1	121.1	105.1	97.0	122.8	118.6	
3Peak		99.1	121.0	125.3	78.7	74.0	77.9	72.7	63.9
STM	132.0	103.2	84.8	91.3	101.0	96.2	92.4	103.6	104.3
Texas Instruments	168.5	138.6	124.8	115.6	112.7	114.0	117.6	128.5	126.4
Verisilicon		32.2	34.3	37.1	30.6	27.0	38.7	50.0	29.7
Will Semi	206.0	119.5	115.1	122.6	135.9	175.3	223.4	266.7	308.6
Non-Memory Average	125.2	101.8	94.1	102.7	100.5	102.8	105.2	118.2	122.2

Source: Company data, UBS

Figure 43: Absolute Inventories – Non-Memory Semiconductors

(USD mn)	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Mar-22
Non - Memory Semis									
AMD	1,324	1,292	1,399	1,659	1,765	1,902	1,955	2,431	2,648
AMLogic	56	33	51	59	95	134	168	207	180
Analog Devices	613	608	618	641	658	1,201	973	1,075	1,203
Austriamicrosystems	246	890	858	890	879	829	938	947	985
Broadcom (Avago)	1,081	1,003	952	1,004	1,160	1,297	1,520	1,668	
Cirrus Logic	199	209	142	173	193	188	149	138	174
Diodes Inc	256	260	307	290	304	322	349	370	371
Giga Device	129	102	113	137	171	180	227	267	
Goodix	114	99	95	95	113	152	153	204	
Guoxin Micro	127	124	137	153	160	185	191	206	247
Ingenic	224	205	200	192	191	200	222	248	
Infineon	2,434	2,386	2,414	2,334	2,473	2,566	2,666	2,955	2,971
Intel	8,969	9,273	8,427	8,487	8,817	9,798	10,776	11,935	12,174
Lattice	54	60	65	60	66	66	68	72	78
Magnachip	46	34	39	30	41	39	39	37	36
Marvell	263	268	268	538	460	629	720	836	913
Maxscend	76	59	97	110	136	179	231	244	
Mediatek	1,231	1,054	1,331	2,007	2,257	2,468	2,588	3,197	3,074
Melexis	163	149	144	124	155	158	170	182	195
Microchip	657	661	661	665	684	714	768	854	912
Montage Tech	25	29	29	30	44	45	59	63	100
Novatek	316	261	282	344	387	440	510	584	633
NXP	1,228	1,064	1,030	1,056	1,116	1,173	1,189	1,311	1,462
Nvidia	1,401	1,495	1,826	1,992	2,114	2,233	2,605	3,163	3,889
ON Semiconductor	1,285	1,281	1,251	1,295	1,309	1,327	1,379	1,496	1,563
Qorvo	524	477	479	508	570	598	710	756	847
Qualcomm	2,343	2,598	2,552	2,668	3,133	3,228	3,861	4,555	5,418
Realtek	289	271	305	347	467	557	595	625	665
Renesas	946	913	870	817	862	1,228	1,214	1,381	1,277
Rockchip	43	39	37	41	46	65	74	99	124
Rohm	1,122	1,132	1,156	1,215	1,155	1,174	1,224	1,378	1,227
SGMicro	38	34	40	47	50	56	62	64	68
Silergy	84	83	82	85	80	89	100	112	121
Skyworks	698	806	718	740	809	885	839	928	1,102
Starpower	31	35	39	43	45	50	62	65	
3Peak		9	11	15	16	19	23	24	24
STM	1,963	1,931	1,841	1,843	1,970	1,969	1,972	2,147	2,307
Texas Instruments	2,136	2,072	1,955	1,890	1,856	1,863	1,910	2,060	2,199
Verisilicon		12	13	14	17	19	21	24	21
Will Semi	909	808	809	861	939	1,110	1,374	1,630	1,887
Agg. Non-Memory Semis	31,996	32,617	32,147	33,919	35,957	39,292	42,259	47,873	51,127
QoQ%	8.3%	1.9%	-1.4%	5.5%	6.0%	9.3%	7.6%	13.3%	6.8%
YoY%	11.6%	15.9%	14.8%	14.8%	12.4%	20.5%	31.5%	41.1%	42.2%

Source: Company data, UBS

Figure 44: Inventory days – Memory Semis, Foundries and OSAT

	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-21	Jun-21
Memory									
SK Hynix	100.8	106.2	101.2	99.4	95.9	98.4	123.1	140.5	142.1
Micron	134.2	128.5	124.6	87.7	96.4	93.9	107.1	119.6	111.6
Nanya Technology	132.2	135.1	128.4	90.5	79.0	83.9	124.7	96.8	126.8
Samsung Electronics	84.8	74.1	77.4	68.4	83.5	78.5	80.4	92.3	100.6
Western Digital	87.4	100.4	109.4	110.3	98.4	95.5	102.4	104.6	107.7
Memory Average	107.9	108.8	108.2	91.3	90.6	90.0	107.5	110.8	117.7
Foundry									
Hua Hong	96.8	97.7	99.1	152.9	124.7	109.7	105.9	121.1	105.0
SMIC	88.5	72.0	90.6	98.9	88.5	106.5	106.0	110.1	114.7
TSMC	53.6	60.2	75.5	82.6	85.3	84.3	87.1	83.8	89.9
UMC	62.4	59.4	62.3	59.2	59.7	60.8	62.5	64.5	64.0
Vanguard	47.9	47.6	51.4	54.3	56.3	55.2	56.5	55.8	54.7
Foundry- Average	69.8	67.4	75.8	89.6	82.9	83.3	83.6	87.1	85.7
OSAT									
Amkor	28.6	24.6	24.8	26.4	30.1	30.0	32.5	37.1	46.3
ASE	52.1	55.5	45.0	63.4	61.0	60.7	48.9	67.9	67.9
Chipbond	32.3	29.2	27.6	34.0	32.3	31.3	31.2	31.6	33.2
Chipmos	49.1	41.2	40.2	42.9	46.9	46.9	59.7	57.2	54.8
JiangsuChangjiang Electronic Tech.	46.1	50.8	41.3	43.4	46.6	51.6	43.4	45.1	55.6
Powertech	41.0	31.0	29.9	32.0	32.0	31.5	36.9	44.9	46.1
OSAT - Average	41.5	38.7	34.8	40.3	41.5	42.0	42.1	47.3	50.7

Source: Company data, UBS

Figure 45: Absolute Inventories – Memory Semis, Foundries and OSAT

(USD mn)	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22
Memory									
SK Hynix	4,765	5,178	5,650	5,550	5,554	5,694	7,535	8,932	9,223
Micron	5,405	5,607	5,521	4,743	4,537	4,487	4,827	5,383	5,629
Nanya Technology	555	572	573	437	396	390	519	425	475
Samsung Electronics	24,295	27,311	29,506	27,486	29,960	32,613	34,971	40,903	40,444
Western Digital	3,070	3,355	3,576	3,683	3,616	3,544	3,647	3,661	3,638
Agg. Memory Semi	38,089	42,023	44,826	41,898	44,062	46,728	51,498	59,305	59,409
QoQ%	2.2%	10.3%	6.7%	-6.5%	5.2%	6.1%	10.2%	15.2%	0.2%
YoY%	-5.5%	6.6%	24.7%	12.4%	15.7%	11.2%	14.9%	41.5%	34.8%
Foundry									
Hua Hong	177	205	226	390	356	396	434	577	474
SMIC	669	647	799	890	973	1,105	1,194	1,317	1,449
TSMC	2,868	3,724	4,859	5,475	6,091	6,539	6,939	7,159	7,311
UMC	780	777	830	787	802	831	827	909	919
Vanguard	96	98	109	119	130	137	145	152	156
Aggregate	4,591	5,451	6,823	7,661	8,352	9,007	9,538	10,113	10,309
QoQ%	9.2%	18.7%	25.2%	12.3%	9.0%	7.8%	5.9%	6.0%	1.9%
YoY%	-8.3%	17.6%	58.5%	82.3%	81.9%	65.2%	39.8%	32.0%	23.4%
OSAT									
Amkor	307	300	297	307	374	446	485	516	637
ASE	1,693	2,140	2,190	2,371	2,393	2,793	2,632	3,084	3,183
Chipbond	44	44	47	59	58	57	52	56	55
ChipMoS	77	69	74	81	90	94	115	113	104
JiangsuChangjiang Electronic Techn	376	453	452	409	452	568	500	508	563
Powertech	186	177	176	179	194	206	243	286	305
Aggregate	2,684	3,183	3,236	3,406	3,561	4,163	4,027	4,563	4,847
QoQ%	5.7%	18.6%	1.7%	5.3%	4.5%	16.9%	-3.3%	13.3%	6.2%
YoY%	19.9%	36.8%	39.8%	34.1%	32.7%	30.8%	24.4%	34.0%	36.1%

Source: Company data, UBS

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Neutral	FSR is between -6% and 6% of the MRA.	35%	26%
Sell	FSR is > 6% below the MRA.	9%	21%
Short-Term Rating	Definition	Coverage ³	IB Services ⁴
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 June 2022.

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Company Name	Reuters	12-month rating	Price	Price date
ASM International	ASMI.AS	Buy	€275.90	29 Aug 2022
Analog Devices Inc ^{7,16b}	ADI.O	Buy	US\$155.19	29 Aug 2022
Broadcom Inc. ^{16b}	AVGO.O	Buy	US\$514.18	29 Aug 2022
GigaDevice Semiconductor	603986.SS	Neutral	Rmb114.49	29 Aug 2022
Infineon Technologies AG	IFXGn.DE	Buy	€24.24	29 Aug 2022
Marvell Technology Group ^{16b}	MRVL.O	Buy	US\$48.99	29 Aug 2022
MediaTek Inc.	2454.TW	Buy	NT\$653.00	29 Aug 2022
Melexis NV	MLXS.BR	Sell	€75.55	29 Aug 2022
Micron Technology Inc ^{16b}	MU.O	Buy	US\$57.01	29 Aug 2022
NXP Semiconductors ^{16b}	NXPI.O	Sell	US\$165.88	29 Aug 2022
SK Hynix	000660.KS	Buy	Won92,500	29 Aug 2022
Samsung Electronics	005930.KS	Buy	Won58,600	29 Aug 2022
Semiconductor Manufacturing Intl Corp ^{18,16a,20}	0981.HK	Sell (CBE)	HK\$15.30	29 Aug 2022
Taiwan Semiconductor Manufacturing ^{13,16b}	2330.TW	Buy	NT\$498.50	29 Aug 2022
Texas Instruments Inc ^{16b}	TXN.O	Neutral	US\$167.94	29 Aug 2022
Vanguard	5347.TWO	Sell	NT\$73.20	29 Aug 2022

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