

Memory sector

Shifting from output cuts & price protection to price & volume growth

Overweight • Maintained

Key message

1. Micron has eased its DRAM output reductions since the middle of 4Q23, as it was the first firm to complete inventory digestion.
2. We predict DRAM wafer makers will start to increase capacity utilization in 4Q23-2Q24F due to the completion of inventory digestion, which will boost prices and output volume, and enable an earnings recovery that outpaces module makers.
3. We recommend investors adjust investment weightings for subsectors, shifting from NAND Flash to DRAM manufacturers, and from module makers to wafer makers.

Event

Micron (US) has eased its DRAM output reductions since the middle of 4Q23, as it was the first firm to complete inventory digestion. We predict DRAM wafer makers will start to increase capacity utilization in 4Q23-2Q24F due to the completion of inventory digestion, which will boost prices and output volume, and enable an earnings recovery that outpaces module makers.

Impact

4Q23 contract price rises sharper than expected. DRAM contract prices for 4Q23 have been by and large finalized, with DDR5 up 15%, DDR4 up 10-15% and DDR3 up 10%, beating our forecasts by 5-10%, due to the following: (1) robust sales of Huawei's (CN) new Mate 60 have spurred Android handset makers to launch new models early, boosting DRAM demand; (2) Samsung (KR) adopts shipment control, causing PC makers to take longer time to restock; (3) DRAM makers are adjusting wafer starts for 3Q23-1Q24F from server DRAM to mobile and PC DRAM in response to revised-up handset demand, mitigating the oversupply of server DRAM; and (4) downstream manufacturers of niche products, such as webcams and networking equipment, have started restocking memory in anticipation of price increases. DRAM spot price rises have been slowing since November, reflecting a peak for large and small module makers' order streams for the year-end holiday season, in August-September and September-October, respectively. In addition, distributors, expecting price rises, have mostly completed inventory restocking.

Cutting output to protect prices in 2023F; price & volume up in 2024F. In 4Q23, Micron successfully digested DRAM inventory down to 8 weeks, and eased the extent of DRAM output reductions from 31% in 3Q23 to 17%. Moreover, it plans to keep the extent of its output cuts unchanged throughout 2024F. Trailing Micron by one quarter in terms of lowering production and destocking, Samsung and SK Hynix (KR) expect to narrow their reduction of output from 18-40% in 4Q23 to 15-34% in 1Q24F, and further ease reductions sequentially in 2Q-4Q24F. Given an expected pickup in end demand in 2Q24F, and disciplined sales-based production increases being implemented by all leading manufacturers, we predict DRAM contract prices will be on the rise in 2024F. As inventory remains at a high level of 15-18 weeks, NAND flash makers have not significantly eased production cuts.

Wafer makers' price & volume growth will outpace module peers. In 3Q-4Q23, the earnings and share valuations of module makers have been stronger than those of their wafer counterparts, mainly because module makers could enjoy inventory benefits without bearing losses on idled capacity. We believe that from 1H24F onwards, wafer makers' earnings and share valuations will be higher than module makers', because: (1) as wafer makers increase capacity utilization, losses on idled capacity will decrease, helping earnings; and (2) module makers' margins will narrow alongside declines in spot prices. We expect Nanya Technology (2408 TT, NT\$70.1, OP) will increase its capacity utilization starting in 2Q24F, as DDR3 inventory adjustments have lagged behind due to TV makers lowering capacity utilization during 4Q23-1Q24F.

Stocks for Action

We believe DRAM makers increasing their capacity utilization indicates that the memory sector cycle has entered a new phase. We recommend investors adjust investment weightings for subsectors, shifting from NAND Flash to DRAM manufacturers, and from module makers to wafer makers.

Risks

Slower-than-expected production node migration; weakening market demand.

Figure 1: Comparison – Stock valuations

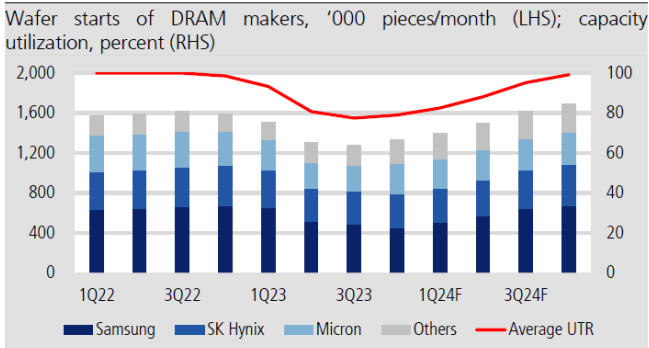
Ticker	Company	Revenue contribution of related products(%)	Market cap (US\$m)	Price (NT\$)	Rating	Target price (NT\$)	Upside/downside(%)	EPS (NT\$)		
								2022	2023F	2024F
2408 TT	Nanya Technology	DRAM(100)	6,301	70.10	OP	85	21	4.72	(2.10)	2.83
2344 TT	Winbond	DRAM(29), NAND Flash(6)	3,122	26.80	NR	N.A.	N.A.	3.25	0.29	1.94
3260 TT	ADATA	DRAM module(45), SSD module(36)	769	94.10	NR	N.A.	N.A.	3.12	4.78	7.44
8299 TT	Phison	SSD module(80), controller IC(17)	2,847	459.00	NR	N.A.	N.A.	27.71	13.57	28.68

Source: Bloomberg; KGI Research

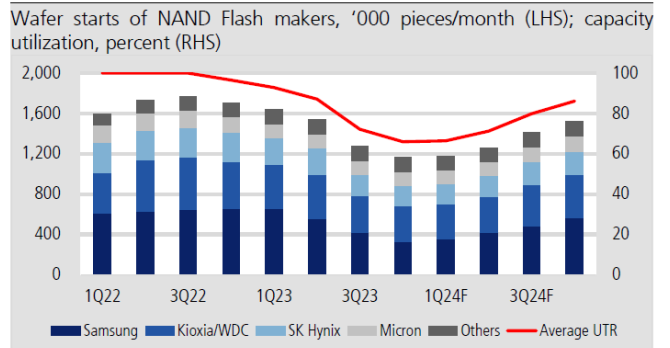
Figure 2: Breakdown of DRAM & NAND Flash supply, demand & pricing

%	2023				2024				2022	2023	2024	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q				
DRAM												
Bit supply growth										19	(4)	15
Wafer output YoY growth										7	(15)	15
Wafer output QoQ/YoY growth (kwpm)	(84)	(201)	(25)	50	66	101	124	73		98	(237)	197
Bit demand growth										12	8	15
Sufficiency rate	113	105	89	83	91	95	98	102		108	97	97
DDR4 8Gb contract price QoQ growth	(18)	(22)	(6)	12	10	10	15	15				
NAND Flash												
Bit supply growth										30	(2)	7
Wafer output QoQ/YoY growth										5	(17)	(5)
Wafer output growth (kwpm)	(65)	(100)	(264)	(109)	8	85	151	111		82	(295)	(64)
Bit demand growth										19	11	16
Sufficiency rate	120	112	89	75	85	85	91	96		110	97	90
512Gb TLC wafer contract price QoQ growth	(11)	(14)	3	15	10	15	20	5				

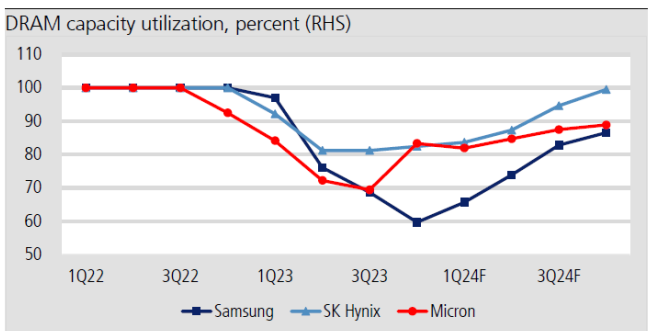
Source: TrendForce; KGI Research

Figure 3: DRAM makers will ease output reductions from 1Q24F


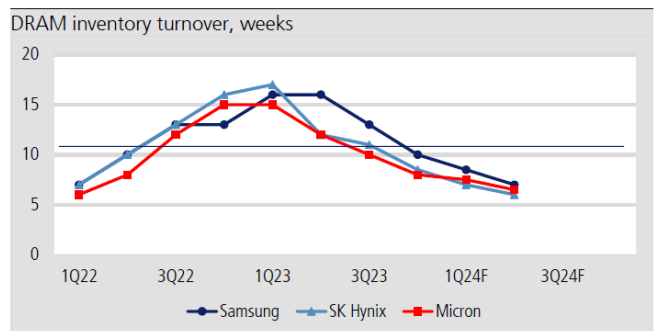
Source: TrendForce; KGI Research

Figure 4: NAND Flash makers will ease output reductions from 2Q24F


Source: TrendForce; KGI Research

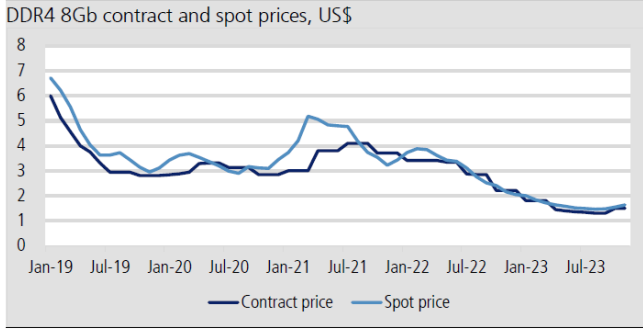
Figure 5: Micron led in output cuts in 4Q22; capacity utilization increase in 4Q23F


Source: TrendForce; KGI Research

Figure 6: Micron led in cutting inventory to 10 weeks in 3Q23


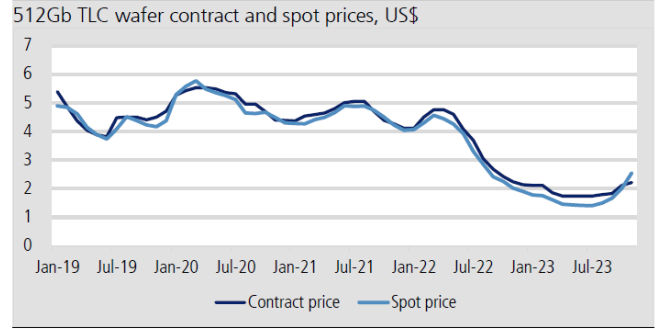
Source: TrendForce; KGI Research

Figure 7: DDR4 spot prices started rising in September; contract prices rose in 4Q23



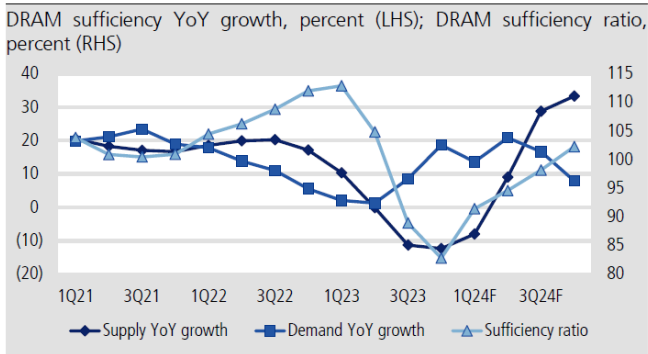
Source: TrendForce; KGI Research

Figure 8: NAND Flash spot & contract prices started rising in 3Q23



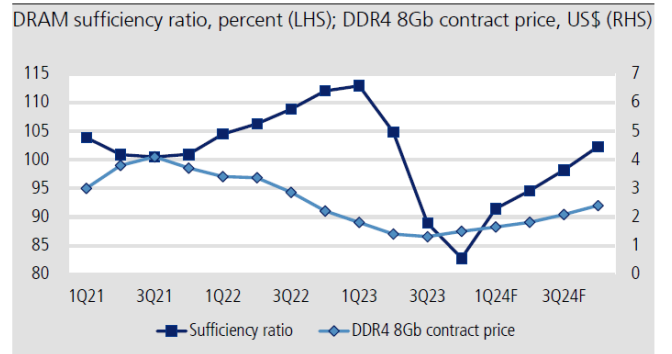
Source: TrendForce; KGI Research

Figure 9: Oversupply in the DRAM market eased from 3Q23



Source: TrendForce; KGI Research

Figure 10: DRAM price uptrend will start in 4Q23F



Source: TrendForce; KGI Research

Figure 11: Inventories of DRAM makers & downstream consumers

week	Healthy level	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23F	1Q24F	2Q24F
Hyperscaler	7-8	Destock 7-9	Restock 7-8	Destock 10-12	Destock 11-13	Destock 9-13	Destock 8-10	Destock 7-9	De>restock 8-10	Restock	Restock
Smartphone	5-6	Destock 7-9	Destock 7-9	Destock 7-9	Destock 6-8	Destock 5-7	Destock 5-7	De>restock 8-10	Restock 9-11	Restock	Restock
PC OEM	5-6	De>restock 8-10	Destock 10-14	Destock 10-14	Destock 10-14	Destock 9-13	Destock 8-11	De>restock 12-14	Restock 13-15	Restock	Restock
Module house	5-6	De>restock 8-10	Destock 7-9	Destock 9-11	Destock 8-11	Destock 9-13	Restock 9-20	Restock 12-22	Restock 15-20	Restock	Restock
DRAM maker	4-5	5-7	8-10	12-13	15	14-17	12-14	10-12	8-10	7-8	Less

Source: TrendForce; KGI Research

Figure 12: Overview of DRAM producers' 2016-24 annual production capacity

(k piece/month)	2016	2017	2018	2019	2020	2021	2022	2023F	2024F
Capacity	962	1,066	1,191	1,298	1,364	1,495	1,593	1,356	1,553
Samsung	336	305	415	463	495	584	653	527	598
SK Hynix	255	310	325	349	344	356	393	346	374
Micron	245	320	310	341	349	355	353	278	309
Nanya	60	60	65	71	71	71	68	54	58
Winbond	17	21	26	27	27	26	21	24	24
Powerchip	49	50	50	49	44	47	43	27	38
CXMT	0	0	0	0	31	50	54	90	143
JHICC	0	0	0	0	3	6	9	10	10
YoY growth		104	125	107	66	131	98	(237)	197
Samsung		(31)	110	48	33	89	69	(125)	70
SK Hynix		56	15	24	(5)	12	37	(47)	29
Micron		75	(10)	31	8	6	(2)	(75)	31
Nanya		0	5	6	(0)	0	(3)	(14)	4
Winbond		4	5	1	1	(1)	(5)	3	(0)
Powerchip		1	0	(2)	(4)	3	(4)	(16)	11
CXMT		0	0	0	31	19	4	37	52
JHICC		0	0	0	3	3	3	1	0

Source: TrendForce; KGI Research

Figure 13: Overview of DRAM producers' 1Q22-4Q24 quarterly production capacity

	2022				2023				2024			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Total wafer output (k)	1,575	1,591	1,614	1,591	1,507	1,306	1,281	1,331	1,397	1,498	1,622	1,695
Samsung	635	640	665	670	651	513	490	455	505	570	640	675
SK Hynix	380	390	390	410	378	333	333	338	343	358	388	408
Micron	360	360	360	333	303	260	250	300	295	305	315	320
Nanya	71	71	71	60	53	58	54	52	53	55	60	65
Winbond	24	23	21	17	21	25	27	24	24	24	24	24
Powerchip	47	47	43	34	26	26	24	30	32	36	40	43
CXMT	50	52	55	57	65	81	93	122	135	140	145	150
JHICC	8	8	9	10	10	10	10	10	10	10	10	10
QoQ growth	22	16	23	(23)	(84)	(201)	(25)	50	66	101	124	73
Samsung	10	5	25	5	(19)	(138)	(23)	(35)	50	65	70	35
SK Hynix	10	10	0	20	(32)	(45)	0	5	5	15	30	20
Micron	5	0	0	(27)	(30)	(43)	(10)	50	(5)	10	10	5
Nanya	0	0	0	(11)	(7)	5	(4)	(2)	1	2	5	5
Winbond	(3)	(1)	(2)	(4)	4	4	2	(3)	0	0	0	0
Powerchip	(1)	0	(4)	(9)	(8)	0	(2)	6	2	4	4	3
CXMT	0	2	3	2	8	16	12	29	13	5	5	5
JHICC	1	0	1	1	0	0	0	0	0	0	0	0

Source: TrendForce; KGI Research

Figure 14: Overview of NAND Flash producers' 2019-24 annual production capacity

(k piece/month)	2019	2020	2021	2022	2023F	2024F
Capacity	1,364	1,484	1,616	1,698	1,403	1,339
Samsung	465	490	574	636	489	454
Kioxia/WDC	404	494	496	475	401	388
SK Hynix	221	198	195	293	234	218
Micron	154	165	170	169	134	143
Intel	85	85	89	0	0	0
YMTC	13	26	66	98	120	110
Powerchip	3	4	3	5	4	4
Winbond	5	7	6	7	8	8
Macronix	10	10	11	13	12	13
SMIC	5	5	5	4	3	3
YoY growth		120	132	82	(295)	(64)
Samsung		25	84	62	(147)	(35)
Kioxia/WDC		91	2	(21)	(75)	(13)
SK Hynix		(24)	(3)	98	(59)	(17)
Micron		11	5	(2)	(35)	9
Intel		0	4	(89)	0	0
YMTC		14	40	31	23	(10)
Powerchip		1	(1)	2	(1)	1
Winbond		2	(1)	1	1	1
Macronix		1	1	2	(1)	1
SMIC		0	0	(1)	(1)	0

Source: TrendForce; KGI Research

Figure 15: Overview of NAND Flash producers' 1Q22-4Q24 quarterly production capacity

(k piece/month)	2022				2023				2024			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Total wafer output	1,597	1,727	1,764	1,702	1,637	1,537	1,273	1,164	1,172	1,257	1,408	1,519
Samsung	612	630	645	655	656	555	415	330	355	415	485	560
Kioxia/WDC	404	511	522	463	439	440	366	357	350	360	405	435
SK Hynix	293	293	293	293	263	263	210	200	200	210	230	230
Micron	172	172	175	155	135	135	135	130	130	135	150	155
Intel	0	0	0	0	0	0	0	0	0	0	0	0
YMTC	90	95	100	105	120	120	120	120	110	110	110	110
Powerchip	4	4	5	5	3	3	4	4	4	4	4	4
Winbond	7	7	7	7	7	7	8	8	8	8	8	8
Macronix	11	11	13	15	11	11	12	12	12	12	13	14
SMIC	4	4	4	4	3	3	3	3	3	3	3	3
QoQ growth	(92)	130	37	(62)	(65)	(100)	(264)	(109)	8	85	151	111
Samsung	(3)	18	15	10	1	(101)	(140)	(85)	25	60	70	75
Kioxia/WDC	(101)	107	11	(59)	(24)	1	(74)	(9)	(7)	10	45	30
SK Hynix	98	0	0	0	(30)	0	(53)	(10)	0	10	20	0
Micron	2	0	3	(20)	(20)	0	0	(5)	0	5	15	5
Intel	(93)	0	0	0	0	0	0	0	0	0	0	0
YMTC	5	5	5	5	15	0	0	0	(10)	0	0	0
Powerchip	1	0	1	0	(2)	0	1	0	0	0	0	0
Winbond	0	0	0	0	0	0	1	0	0	0	0	0
Macronix	0	0	2	2	(4)	0	1	0	0	0	1	1
SMIC	(1)	0	0	0	(1)	0	0	0	0	0	0	0

Source: TrendForce; KGI Research

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