

## Universal Display

# Positive guidance and promising 2025: Tweak up PO to \$260, reiterate Buy

Reiterate Rating: BUY | PO: 260.00 USD | Price: 187.14 USD

## Time to see meaningful growth and profit generation

We reiterate Buy on Universal Display Corp (UDC). New guidance for 2024 sales (\$625-675mn) indicates 13% YoY top-line growth following 7% YoY decline in 2023. We expect slightly higher sales growth in 2024 (+14%) on potentially stronger OLED demand in 2Q/2H24 (Apple's new iPad introduction; TV industry turnaround, including positive impact of the Summer Olympics event; mild growth among China/Apple/Samsung smartphones; penetration ratio increase in auto display; Samsung's new 8.6G fab construction). UDC's new blue material sales are also likely to be more meaningful toward end-2024. UDC raised its quarterly dividend to \$0.40 (effective 1Q24) from \$0.30/0.35 in 2022/23 quarters. Our 2024E EPS revision (+3%) is mostly based on slightly higher sales/OP (1%+/-) assumptions. Our new PO of \$260 is derived from 55x 2024E P/E (54x previously; historical average 47x) given record-high EPS in 2024-26E (\$5+/- vs \$4 range in 2021-23).

## 4Q23 sales slightly missed, but high margin well retained

UDC reported slightly lower-than-expected 4Q23 sales (22 Feb US time): \$158mn (+12% QoQ; -6% YoY) vs consensus/our estimate of low-\$160mn. However, GM/OPM (77%/41%) remained high, meeting consensus. The sales miss appears to be a matter of channel inventory adjustments but was mostly offset by upbeat royalty/license income of \$73mn (+59% QoQ; -4% YoY). EPS (\$1.30) was higher than our estimate/ consensus (~\$1.20) on the back of lower effective tax rate (18% vs normal low-20%) and strong interest income (net cash \$0.8bn). Its 2023 annual sales (\$576mn) came within the guidance range (\$565-590mn).

## Likely resilient 1H24 and then solid momentum from 2H

We believe UDC will manage well the 1H low season. Three reasons: 1) stable royalty, 2) channel inventory restocking (single-digit% material sales growth QoQ but 20%+ YoY), and 3) sustainable high margin along with limited price cut. Overall, 1H sales/OP/ EPS will likely grow 10%+ YoY. 2H growth/margin is likely to be stronger/better vs 1H on new demand (iPad), seasonality (iPhone 16, TV), and customers' capacity expansion.

Estimates (Dec) (US\$)	2022A	2023A	2024E	2025E	2026E
Net Income (Adjusted - mn)	210	203	227	248	262
EPS	4.42	4.26	4.76	5.20	5.50
EPS Change (YoY)	13.8%	-3.7%	11.7%	9.4%	5.7%
Dividend / Share	1.20	1.40	1.60	1.80	2.00
Free Cash Flow / Share	1.78	1.99	3.93	5.29	5.66
Valuation (Dec)					
P/E	42.3x	43.9x	39.3x	36.0x	34.0x
Dividend Yield	0.6%	0.7%	0.9%	1.0%	1.1%
EV / EBITDA*	26.6x	31.6x	26.3x	23.7x	22.4x
Free Cash Flow Yield*	1.0%	1.1%	2.1%	2.8%	3.0%

\* For full definitions of *IQmethod*<sup>SM</sup> measures, see page 15.

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**Refer to important disclosures on page 17 to 19. Analyst Certification on page 14. Price Objective Basis/Risk on page 14.**

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Timestamp: 23 February 2024 06:52AM EST

23 February 2024

### Equity

#### Key Changes

(US\$)	Previous	Current
Price Obj.	250.00	260.00
2024E EPS	4.64	4.76
2025E EPS	5.17	5.20
2026E EPS	NA	5.50
2024E EBITDA (m)	308.5	313.4
2025E EBITDA (m)	344.3	347.3
2026E EBITDA (m)	NA	367.6

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### Stock Data

Price	187.14 USD
Price Objective	260.00 USD
Date Established	23-Feb-2024
Investment Opinion	B-1-7
52-Week Range	125.38 USD-194.84 USD
Mrkt Val / Shares Out (mn)	8,864 USD / 47.4
Average Daily Value (mn)	46.80 USD
Free Float	92.6%
BofA Ticker / Exchange	OLED / NAS
Bloomberg / Reuters	OLED US / OLED.OQ
ROE (2024E)	14.9%
Net Dbt to Eqty (Dec-2023A)	-35.52%

**8.6G:** OLED fab glass size – gen 8.6

**OLED:** Organic light-emitting diode

**GM:** Gross margin

**OPM:** Operating profit margin

# iQprofile<sup>SM</sup> Universal Display

## Key Income Statement Data (Dec)

(US\$ Millions)

	2022A	2023A	2024E	2025E	2026E
Sales	617	576	654	717	768
Gross Profit	489	441	507	557	595
Sell General & Admin Expense	(106)	(93)	(104)	(116)	(130)
Operating Profit	267	217	265	297	315
Net Interest & Other Income	1	28	26	21	21
Associates	NA	NA	NA	NA	NA
Pretax Income	268	245	291	318	336
Tax (expense) / Benefit	(58)	(42)	(64)	(70)	(74)
Net Income (Adjusted)	210	203	227	248	262
Average Fully Diluted Shares Outstanding	47	48	48	48	48

## Key Cash Flow Statement Data

Net Income	210	203	227	248	262
Depreciation & Amortization	42	43	49	50	53
Change in Working Capital	111	98	(28)	14	15
Deferred Taxation Charge	NA	NA	NA	NA	NA
Other Adjustments, Net	(237)	(190)	0	0	0
Cash Flow from Operations	127	155	247	312	330
Capital Expenditure	(42)	(60)	(60)	(60)	(60)
(Acquisition) / Disposal of Investments	NA	NA	NA	NA	NA
Other Cash Inflow / (Outflow)	(238)	(24)	0	0	0
Cash Flow from Investing	(281)	(83)	(60)	(60)	(60)
Shares Issue / (Repurchase)	2	2	0	0	0
Cost of Dividends Paid	(57)	(67)	(76)	(86)	(95)
Cash Flow from Financing	(65)	(73)	(76)	(86)	(95)
Free Cash Flow	84	95	187	252	270
Net Debt	(578)	(514)	(669)	(883)	(1,079)
Change in Net Debt	NA	NA	NA	NA	NA

## Key Balance Sheet Data

Property, Plant & Equipment	143	175	198	226	252
Other Non-Current Assets	490	577	583	589	595
Trade Receivables	93	140	123	129	136
Cash & Equivalents	578	514	669	883	1,079
Other Current Assets	229	263	262	271	280
Total Assets	1,533	1,669	1,835	2,098	2,341
Long-Term Debt	0	0	0	0	0
Other Non-Current Liabilities	122	103	101	102	103
Short-Term Debt	0	0	0	0	0
Other Current Liabilities	136	119	129	130	131
Total Liabilities	257	222	230	233	234
Total Equity	1,275	1,447	1,604	1,865	2,107
Total Equity & Liabilities	1,533	1,669	1,835	2,098	2,341

## iQmethod<sup>SM</sup> - Bus Performance\*

Return On Capital Employed	16.1%	13.8%	13.9%	13.5%	12.6%
Return On Equity	17.7%	14.9%	14.9%	14.3%	13.2%
Operating Margin	43.3%	37.7%	40.5%	41.4%	41.0%
EBITDA Margin	50.2%	45.2%	47.9%	48.5%	47.9%

## iQmethod<sup>SM</sup> - Quality of Earnings\*

Cash Realization Ratio	0.6x	0.8x	1.1x	1.3x	1.3x
Asset Replacement Ratio	1.7x	2.2x	2.0x	1.8x	1.7x
Tax Rate (Reported)	21.7%	17.2%	22.0%	22.0%	22.0%
Net Debt-to-Equity Ratio	-45.3%	-35.5%	-41.7%	-47.3%	-51.2%
Interest Cover	NA	NA	NA	NA	NA

## Key Metrics

\* For full definitions of iQmethod<sup>SM</sup> measures, see page 15.

## Company Sector

Semiconductors

## Company Description

Universal Display was founded in 1994, and is currently a leader in research, development and commercialization of OLED materials with over 6,000 patents worldwide. The company is headquartered in New Jersey, US, and is listed on the NASDAQ index. UDC's business segments include OLED material sales (over-50% of sales), royalty and license fees (40%), and contract research services (2-3%). Key customers are all major global panel makers such as Samsung Display, LG Display, BOE, etc.

## Investment Rationale

Our Buy rating is based on earnings turnaround (tech demand recovery) and new growth opportunities (blue commercialization, Apple's new iPad, customers' capacity expansion). Our target P/E is higher than the historical average at 55x due to 2024-25 EPS growth assumption vs 2023 correction.

## Stock Data

Price to Book Value

5.5x



## Key tables/charts after 4Q23 results

### Exhibit 1: Universal Display Corp (UDC) – 4Q23 results vs consensus and our estimate

Sales slightly missed but margins/EPS exceeded consensus estimate; mostly driven by upbeat royalty and non-operating income (net cash)

(US\$m, US\$)	Actual	QoQ	YoY	Cons.	Act vs Consen	Our est	Act vs our est
<b>Sales</b>	<b>158</b>	<b>12%</b>	<b>-6%</b>	<b>163</b>	<b>-3%</b>	<b>164</b>	<b>-3%</b>
GP	122	14%	-12%	126	-3%	128	-4%
GPM	77.2%	2%	-5%	77.1%	0%	78.2%	-1%
Opex	58	-1%	3%	60	-5%	59	-3%
<b>OP</b>	<b>65</b>	<b>34%</b>	<b>-22%</b>	<b>65</b>	<b>-1%</b>	<b>69</b>	<b>-6%</b>
OPM	40.9%	6.6%	-8.3%	40.0%	1%	42.0%	-1%
Pretax	76	40%	-6%	69	9%	76	-1%
Effective tax rate	18.0%	13.6%	-1.2%	20.0%	-2%	23.0%	-5%
<b>NP</b>	<b>62</b>	<b>20%</b>	<b>-5%</b>	<b>55</b>	<b>12%</b>	<b>59</b>	<b>6%</b>
<b>EPS</b>	<b>1.30</b>	<b>20%</b>	<b>-5%</b>	<b>1.18</b>	<b>11%</b>	<b>1.23</b>	<b>6%</b>

Source: Company, Bloomberg, BofA Global Research estimates. Est = estimate. Cons = consensus. Diff = difference.

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### Exhibit 2: UDC – 2024 quarterly earnings; our estimate vs consensus

Resilient 1H and then solid recovery in 2H – our ex-3Q estimate broadly in-line or better vs consensus

(US\$m, US\$)	1Q24E			2Q24E			3Q24E			4Q24E		
	Our est	Cons	Diff	Our est	Cons	Diff	Our est	Cons	Diff	Our est	Cons	Diff
<b>Sales</b>	<b>151</b>	<b>151</b>	<b>0%</b>	<b>161</b>	<b>157</b>	<b>2%</b>	<b>164</b>	<b>176</b>	<b>-7%</b>	<b>193</b>	<b>187</b>	<b>3%</b>
GP	116	117	-1%	124	121	3%	127	136	-7%	149	145	3%
GPM	76.6%	77.0%	0%	77.4%	77.0%	0%	77.6%	77.5%	0%	77.3%	77.8%	-1%
Opex	56	59	-5%	60	61	-3%	60	63	-5%	67	66	2%
<b>OP</b>	<b>59</b>	<b>57</b>	<b>4%</b>	<b>65</b>	<b>60</b>	<b>8%</b>	<b>67</b>	<b>73</b>	<b>-8%</b>	<b>82</b>	<b>79</b>	<b>3%</b>
OPM	39.3%	37.8%	2%	40.3%	38.0%	2%	40.8%	41.4%	-1%	42.5%	42.6%	0%
Net non opex	-7	-6	n/a	-7	-4	n/a	-6	-6	n/a	-5	-6	n/a
Pretax	66	63	5%	72	64	11%	73	79	-8%	87	86	1%
Effective tax rate	22.0%	20.0%	2%	22.0%	19.5%	2%	22.0%	21.6%	0%	22.0%	20.7%	1%
NP	52	50	3%	56	52	8%	57	62	-8%	68	68	0%
EPS	1.08	1.06	2%	1.17	1.11	6%	1.19	1.32	-10%	1.42	1.41	0%

Source: Company, Bloomberg, BofA Global Research estimates. Est = estimate. Cons = consensus. Diff = difference.

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### Exhibit 3: UDC – 2024-25 annual earnings; our estimate vs consensus

Our 2024-25E sales/OP estimates are slightly more conservative vs consensus

(US\$m, US\$)	2023	2024E			2025E		
	Actual	Our est	Cons	Diff	Our est	Cons	Diff
<b>Sales</b>	<b>576</b>	<b>654</b>	<b>671</b>	<b>-2%</b>	<b>717</b>	<b>813</b>	<b>-12%</b>
GP	441	507	519	-2%	557	636	-12%
GPM	76.5%	77.4%	77.4%	0%	77.7%	78.1%	0%
Opex	224	242	249	-3%	260	284	-8%
<b>OP</b>	<b>217</b>	<b>265</b>	<b>270</b>	<b>-2%</b>	<b>297</b>	<b>352</b>	<b>-16%</b>
OPM	37.7%	40.5%	40.2%	0%	41.4%	43.3%	-2%
Net non opex	-28	-26	-25	n/a	-21	-37	n/a
Pretax	245	291	295	-1%	318	389	-18%
Effective tax rate	17.2%	22.0%	20.7%	1%	22.0%	20.7%	1%
NP	203	227	234	-3%	248	309	-20%
EPS	4.26	4.76	4.89	-3%	5.20	6.42	-19%

Source: Company, Bloomberg, BofA Global Research estimates. Est = estimate. Cons = consensus. Diff = difference.

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**Exhibit 4: UDC – Earnings revisions**

Just slightly raised 2024-25 sales and OP margin; 2024-25 EPS revisions are 1-3% range

US\$mnn, US\$	1Q23	2Q23	3Q23	4Q23	1Q24E	2Q24E	3Q24E	4Q24E	2018	2019	2020	2021	2022	2023	2024E	2025E
<b>EPS</b>																
New	0.84	1.04	1.08	1.30	1.08	1.17	1.17	1.33	1.25	2.94	2.82	3.89	4.43	4.26	4.76	5.20
Old	0.84	1.04	1.08	1.23	1.07	1.16	1.15	1.26	1.25	2.94	2.82	3.89	4.43	4.19	4.64	5.17
Difference	n/a	n/a	n/a	6%	1%	1%	1%	6%	n/a	n/a	n/a	n/a	n/a	2%	3%	1%
<b>Dividend/share</b>																
New	0.35	0.35	0.35	0.35	0.40	0.40	0.40	0.40	0.24	0.40	0.60	0.80	1.20	1.40	1.60	1.80
Old	0.35	0.35	0.35	0.35	0.40	0.40	0.40	0.40	0.24	0.40	0.60	0.80	1.20	1.40	1.60	1.80
Difference	n/a	n/a	n/a	0%	0%	0%	0%	0%	n/a	n/a	n/a	n/a	n/a	0%	0%	0%
<b>Sales</b>																
New	130	147	141	158	151	161	165	177	247	405	429	554	617	576	654	717
Old	130	147	141	164	151	161	165	175	247	405	429	554	617	582	652	717
Difference	n/a	n/a	n/a	-3%	0%	0%	0%	1%	n/a	n/a	n/a	n/a	n/a	-1%	0%	0%
<b>Gross margin</b>																
New	74.7%	78.1%	75.7%	77.2%	76.6%	77.4%	77.5%	78.0%	75.5%	78.8%	78.5%	79.2%	79.3%	76.5%	77.4%	77.7%
Old	74.7%	78.1%	75.7%	78.2%	76.6%	77.4%	77.5%	77.8%	75.5%	78.8%	78.5%	79.2%	79.3%	76.8%	77.4%	77.7%
Difference	n/a	n/a	n/a	-1.0%	0.0%	0.0%	0.0%	0.2%	n/a	n/a	n/a	n/a	n/a	-0.3%	0.1%	0.0%
<b>OP</b>																
New	45	59	48	65	59	65	65	76	57	158	158	228	267	217	265	297
Old	45	59	48	69	59	65	65	72	57	158	158	228	267	221	261	295
Difference	n/a	n/a	n/a	-6%	0%	0%	0%	5%	n/a	n/a	n/a	n/a	n/a	-2%	1%	1%
<b>OP margin</b>																
New	34.8%	40.0%	34.3%	40.9%	39.3%	40.3%	39.4%	42.6%	22.9%	39.1%	36.7%	41.1%	43.3%	37.7%	40.5%	41.4%
Old	34.8%	40.0%	34.3%	42.0%	39.3%	40.3%	39.4%	41.0%	22.9%	39.1%	36.7%	41.1%	43.3%	38.0%	40.0%	41.1%
Difference	n/a	n/a	n/a	-1.1%	0.0%	0.0%	0.0%	1.7%	n/a	n/a	n/a	n/a	n/a	-0.3%	0.5%	0.3%
<b>Pre-tax income</b>																
New	52	64	54	76	66	72	71	82	64	170	164	228	268	245	291	318
Old	52	64	54	76	66	72	71	78	64	170	164	228	268	246	287	316
Difference	n/a	n/a	n/a	-1%	0%	0%	0.0%	5%	n/a	n/a	n/a	n/a	n/a	0%	1%	1%
<b>Effective tax rate</b>																
New	22.8%	22.4%	4.4%	18.0%	22.0%	22.0%	22.0%	22.0%	8.5%	18.6%	18.4%	19.3%	21.7%	17.2%	22.0%	22.0%
Old	22.8%	22.4%	4.4%	23.0%	23.0%	23.0%	23.0%	23.0%	8.5%	18.6%	18.4%	19.3%	21.7%	18.7%	23.0%	22.0%
Difference	n/a	n/a	n/a	-5.0%	-1.0%	-1.0%	-1.0%	-1.0%	n/a	n/a	n/a	n/a	n/a	-1.5%	-1.0%	0.0%
<b>Net profit</b>																
New	40	50	52	62	52	56	56	64	59	138	133	184	210	203	227	248
Old	40	50	52	59	51	55	55	60	59	138	133	184	210	200	221	246
Difference	n/a	n/a	n/a	6%	1%	1%	1.3%	6%	n/a	n/a	n/a	n/a	n/a	2%	3%	1%
<b>ROE - annualized</b>																
New	12.4%	15.1%	15.1%	17.5%	14.3%	15.3%	14.6%	16.0%	8.7%	18.4%	15.5%	18.3%	17.7%	14.9%	14.9%	14.3%
Old	12.4%	15.1%	15.1%	16.4%	13.8%	14.5%	13.8%	14.5%	8.7%	18.4%	15.5%	18.3%	17.7%	14.5%	14.1%	13.7%
Difference	n/a	n/a	n/a	1.1%	0.5%	0.8%	0.8%	1.6%	n/a	n/a	n/a	n/a	n/a	0.4%	0.8%	0.6%
<b>EBITDA</b>																
New	55	69	60	77	71	77	77	88	87	193	195	270	309	261	313	347
Old	55	69	60	80	71	77	77	84	87	193	195	270	309	264	309	344
Difference	n/a	n/a	n/a	-5%	0%	0%	0.3%	5%	n/a	n/a	n/a	n/a	n/a	-1%	2%	1%
<b>Capex</b>																
New	9	18	25	8	15	15	15	15	25	30	28	43	42	60	60	60
Old	9	18	25	15	15	15	15	15	25	30	28	43	42	67	60	60
Difference	n/a	n/a	n/a	-49%	0%	0%	0.0%	0%	n/a	n/a	n/a	n/a	n/a	-11%	0%	0%
<b>Net debt</b>																
New	-859	-771	-793	-814	-827	-865	-936	-974	-515	-651	-735	-831	-838	-814	-974	-1,195
Old	-859	-771	-793	-859	-883	-932	-1,002	-1,033	-515	-651	-735	-831	-838	-859	-1,033	-1,251
Difference	n/a	n/a	n/a	-5%	-6%	-7%	-6.6%	-6%	n/a	n/a	n/a	n/a	n/a	-5%	-6%	-4%
<b>BVPS</b>																
New	27	28	29	30	30	31	33	34	15	17	19	23	27	30	34	39
Old	27	28	29	31	31	33	34	35	15	17	19	23	27	31	35	40
Difference	n/a	n/a	n/a	-2%	-3%	-5%	-4%	-4%	n/a	n/a	n/a	n/a	n/a	-2%	-4%	-3%

Source: Company, BofA Global Research estimates

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**Exhibit 5: UDC – Sales assumption revisions**

Our 2023-25E sales estimate revisions are mostly based on slightly more positive royalty and license business

US\$mnn, US\$	1Q23	2Q23	3Q23	4Q23	1Q24E	2Q24E	3Q24E	4Q24E	2018	2019	2020	2021	2022	2023	2024E	2025E
<b>New estimates</b>																
Material sales	70.2	77.1	92.5	82.2	86.6	92.7	98.6	103.0	153.2	243.4	229.7	318.6	331.1	322.0	380.9	424.0
Red emitter	16.1	16.7	22.1	18.3	20.0	20.0	24.0	25.0	45.3	53.2	50.9	75.2	79.0	73.2	89.0	99.0
Green emitter	53.8	58.0	68.9	62.5	65.0	70.0	71.6	73.0	107.1	189.5	177.9	243.4	251.8	243.2	279.6	295.0
Royalty and license fees	55.2	64.4	45.9	72.9	59.0	62.7	64.0	71.0	80.6	150.0	185.1	219.0	267.1	238.4	256.7	275.0
Contract research services	5.1	5.1	2.7	3.2	5.3	5.3	2.8	3.4	13.6	11.7	14.1	15.9	18.4	16.0	16.8	17.7
<b>Total revenue</b>	<b>130.5</b>	<b>146.6</b>	<b>141.1</b>	<b>158.3</b>	<b>150.9</b>	<b>160.7</b>	<b>165.4</b>	<b>177.4</b>	<b>247.4</b>	<b>405.2</b>	<b>428.9</b>	<b>553.5</b>	<b>616.6</b>	<b>576.4</b>	<b>654.4</b>	<b>716.7</b>
Materials GM	58%	63%	66%	59%	63%	64%	65%	65%	72%	73%	67%	67%	65%	62%	64%	65%
Royalty & other fees GM	94%	95%	95%	97%	95%	96%	96%	96%	82%	88%	92%	95%	96%	95%	96%	96%
<b>Old estimates</b>																
Material sales	70.2	77.1	92.5	94.6	86.6	92.7	98.6	103.0	153.2	243.4	229.7	318.6	331.1	334.3	380.9	424.0
Red emitter	16.1	16.7	22.1	23.0	20.0	20.0	24.0	25.0	45.3	53.2	50.9	75.2	79.0	77.9	89.0	99.0
Green emitter	53.8	58.0	68.9	69.8	65.0	70.0	71.6	73.0	107.1	189.5	177.9	243.4	251.8	250.5	279.6	295.0
Royalty and license fees	55.2	64.4	45.9	64.0	59.0	62.7	64.0	67.0	80.6	150.0	185.1	219.0	267.1	229.5	252.7	273.0
Contract research services	5.1	5.1	2.7	5.0	5.3	5.3	2.8	5.3	13.6	11.7	14.1	15.9	18.4	17.8	18.7	19.6
<b>Total revenue</b>	<b>130.5</b>	<b>146.6</b>	<b>141.1</b>	<b>163.6</b>	<b>150.9</b>	<b>160.7</b>	<b>165.4</b>	<b>175.3</b>	<b>247.4</b>	<b>405.2</b>	<b>428.9</b>	<b>553.5</b>	<b>616.6</b>	<b>581.7</b>	<b>652.2</b>	<b>716.6</b>
Materials GM	58%	63%	66%	66%	63%	64%	65%	65%	72%	73%	67%	67%	65%	64%	64%	65%
Royalty & other fees GM	94%	95%	95%	95%	95%	96%	96%	96%	82%	88%	92%	95%	96%	95%	96%	96%
<b>Difference</b>																
Material sales	n/a	n/a	n/a	-12.3	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	-12.3	0.0	0.0
Red emitter	n/a	n/a	n/a	-4.7	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	-4.7	0.0	0.0
Green emitter	n/a	n/a	n/a	-7.3	0.0	0.0	0.0	0.0	n/a	n/a	n/a	n/a	n/a	-7.3	0.0	0.0
Royalty and license fees	n/a	n/a	n/a	8.9	0.0	0.0	0.0	4.0	n/a	n/a	n/a	n/a	n/a	8.9	4.0	2.0
Contract research services	n/a	n/a	n/a	-1.8	0.0	0.0	0.0	-1.9	n/a	n/a	n/a	n/a	n/a	-1.8	-1.9	-2.0
<b>Total revenue</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>-5.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>2.1</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>-5.2</b>	<b>2.1</b>	<b>0.0</b>
Materials GM	n/a	n/a	n/a	-7%	0%	0%	0%	0%	n/a	n/a	n/a	n/a	n/a	-2%	0%	0%
Royalty & other fees GM	n/a	n/a	n/a	2%	0%	0%	0%	0%	n/a	n/a	n/a	n/a	n/a	0%	0%	0%

Source: Company, BofA Global Research estimates

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**Exhibit 6: New OLED capacity planned by big-3 panel makers**

More meaningful new OLED panel production with Samsung's 8.6G and BOE's 6G well expected; long-term positive impact likely on UDC's royalty and material sales

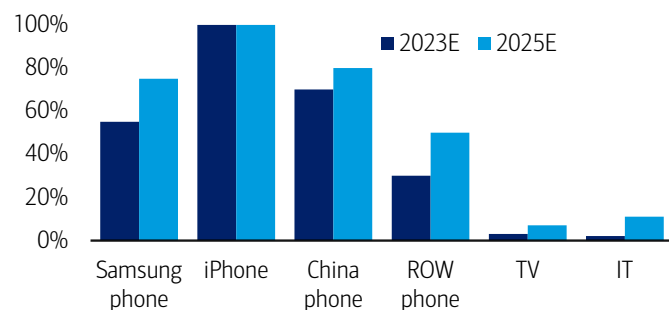
Company	Capacity	Product	Start	Capex
LGD	6G, 15k	iPad, MacBook, other IT	2Q24	US\$2.3bn
SEC	8.6G, 15k	iPad, MacBook, other IT	2H25/1H26	US\$3.1bn
BOE	8.6G, 32k	iPad, MacBook, other IT	2026	US\$8.8bn

Source: Companies, BofA Global Research estimates

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**Exhibit 7: OLED penetration ratio by application**

iPhone already 100% versus 60-70% among Samsung and China domestic phones; thus upside coming from low-end emerging market phones; we still assume 7%/11% penetration ratios for TV/IT products even in 2025 (still LCD dominated despite new iPad/MacBook impact to be conservative)

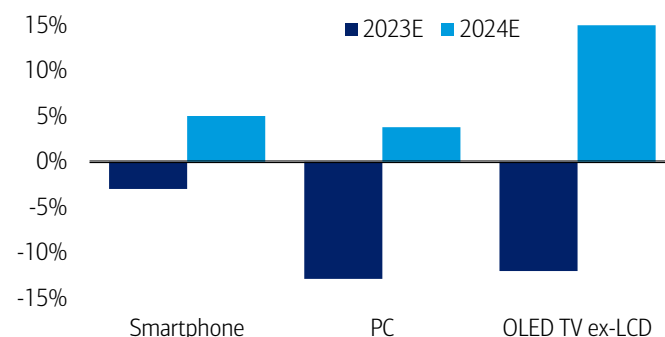


Source: BofA Global Research estimates

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**Exhibit 8: Tech product shipment growth outlook**

2024 better than 2023 downturn – 4-5% shipment growth for PC and smartphone expected but 10%+ for OLED TV possible given exceptionally low base in 2023 (LG Electronics' weaker OLED TV shipment seen)

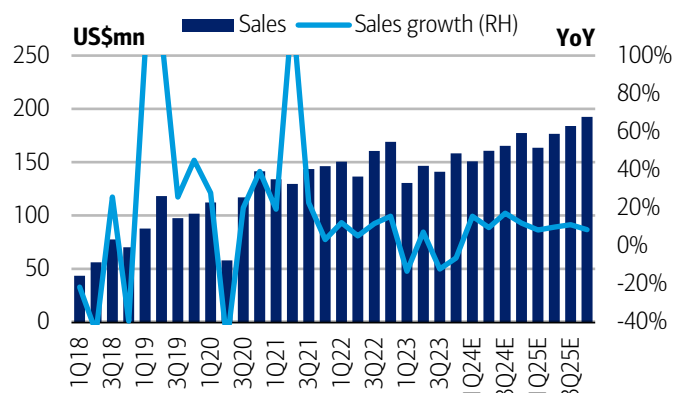


Source: BofA Global Research estimates

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**Exhibit 9: UDC – Quarterly sales and YoY**

We expect 10-14% sales growth in 2024-25E along with global tech demand recovery

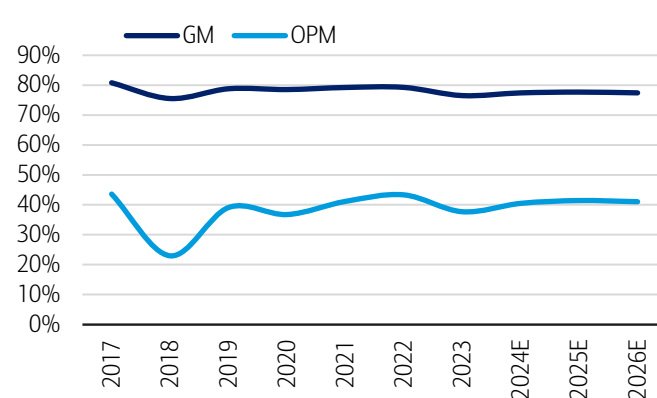


Source: Company, BofA Global Research estimates

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**Exhibit 10: UDC – 2024-25 GM (77%+) and OPM (40%+) assumed**

High margin profile sustainable on the back of market-dominant position (phosphorescent materials) and strong IP power

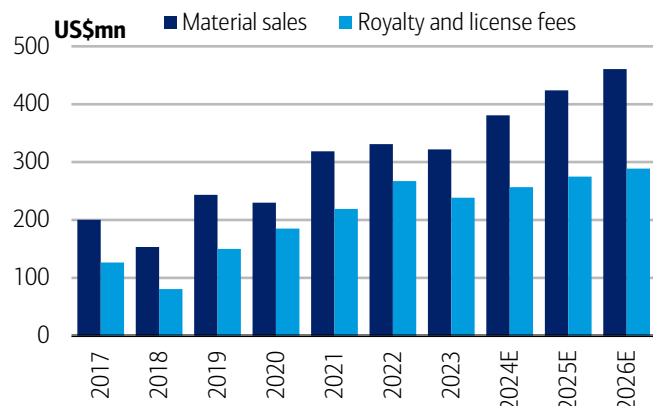


Source: Company, BofA Global Research estimates

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**Exhibit 11: UDC – Material and royalty sales forecast**

Recovery well expected in 2024/25E after 2023 correction

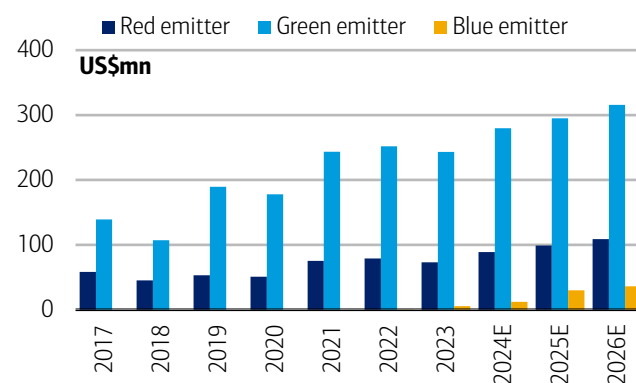


Source: Company, BofA Global Research estimates

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**Exhibit 12: UDC – Material sales by product**

Red/green materials-centric; blue likely more meaningful only from 4Q24 given big-3 panel makers' start-up period (2023, 1H24)

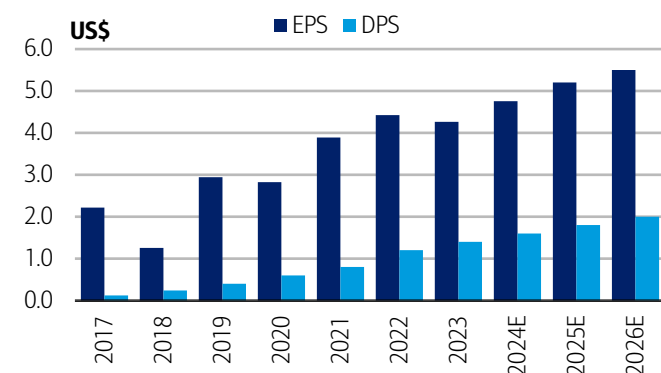


Source: Company, BofA Global Research estimates

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**Exhibit 13: UDC – Annual EPS and DPS**

Quarterly dividend payments likely up gradually due to net cash and strong FCF generation



Source: Company, BofA Global Research estimates

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**Exhibit 14: UDC – 12-month forward P/E**

Currently 40x only vs historical average 47x or our target of 55x

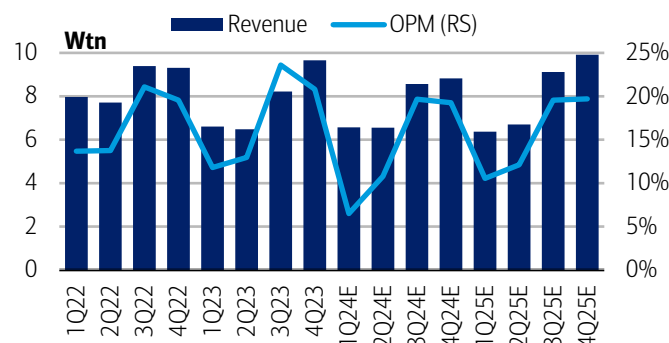


Source: Bloomberg, BofA Global Research estimates

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**Exhibit 15: Samsung Display – Quarterly sales and OPM trend**

1Q24 correction likely deeper than normal but 2H24 recovery and 2025 growth on track due to Apple and captive demand

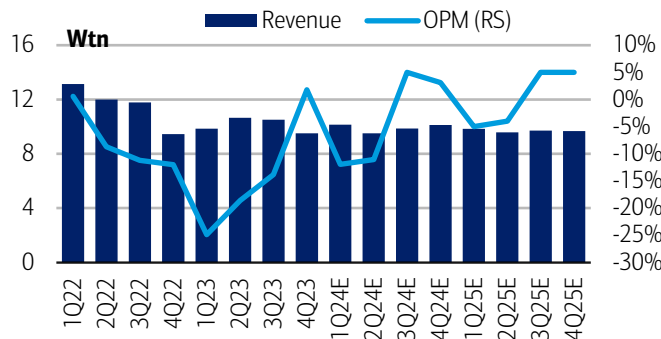


Source: Company, BofA Global Research estimates

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**Exhibit 16: LG Display – Quarterly sales and OPM trend**

OLED panel production increase well-expected from 4Q23 (positive for UDC), but low margin assumed due to competition with Samsung and BOE (negative for LGD itself)

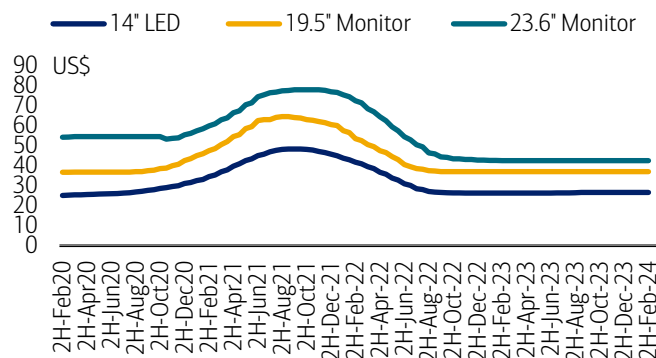


Source: Company, BofA Global Research estimates

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**Exhibit 17: IT panel price trend – US\$/panel**

IT panel prices remained flat; no recovery even as of Feb-24



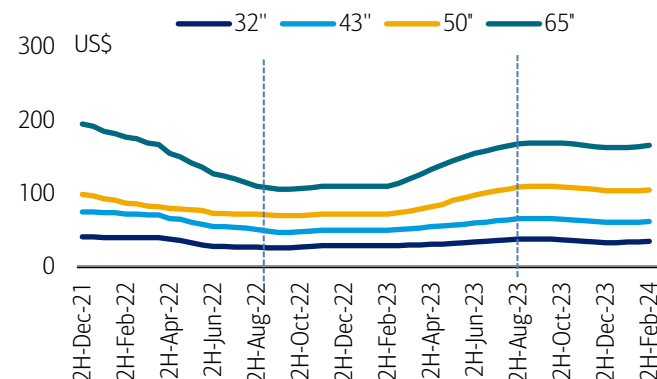
Panel price update from WitsView as of 20 Feb 2024

Source: WitsView, BofA Global Research

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**Exhibit 18: TV panel price trend – US\$/panel**

TV panel price slightly recovered in Feb vs Jan (flat) and Oct-Dec (slightly down)



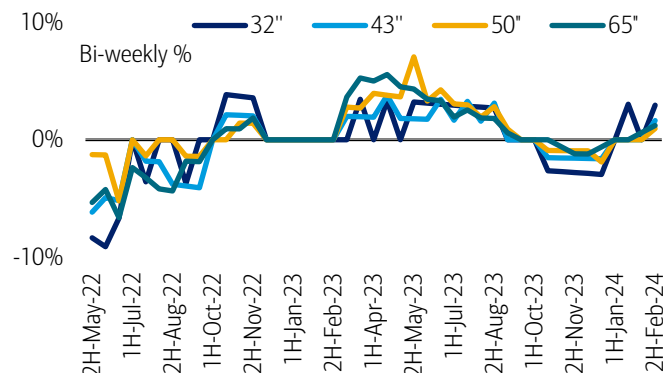
Panel price update from WitsView as of 20 Feb 2024

Source: WitsView, BofA Global Research

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**Exhibit 19: LCD TV panel price trend (bi-weekly sequential)**

Slightly recovered in 2H-Jan/Feb vs correction period (4Q23, Jan-24); previous price rebound period was Mar-Sept 2023



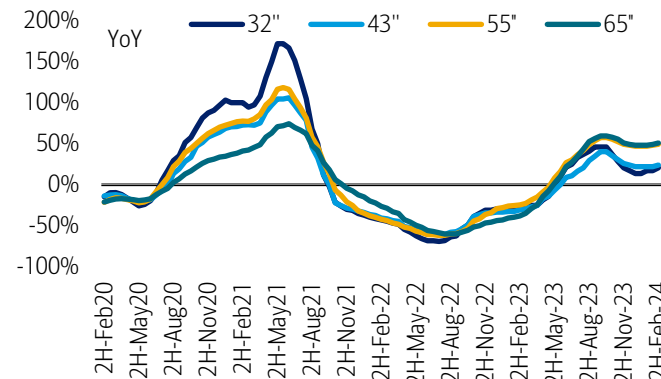
Panel price update from WitsView as of 20 Feb 2024

Source: WitsView, BofA Global Research

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**Exhibit 20: LCD TV panel price trend (YoY)**

Current prices still slightly higher than year ago but upside still low



Panel price update from WitsView as of 20 Feb 2024

Source: WitsView, BofA Global Research

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## Valuation

### Exhibit 21: UDC – Valuation multiples at current price and PO

Our new PO of \$260 is based on 55x 2024E P/E

(x, %)	2020	2021	2022	2023	2024E	2025E	2024-25E avg
<b>Current share price</b>							
P/E	66.3	48.1	42.3	43.9	39.3	36.0	37.7
P/B	9.7	8.1	7.0	6.2	5.5	4.8	5.2
EV/Sales	18.9	14.6	13.1	14.0	12.4	11.3	11.8
EV/EBITDA	41.5	30.0	26.1	31.0	25.8	23.3	24.6
Dividend yield	0.3%	0.4%	0.6%	0.7%	0.9%	1.0%	0.9%
<b>PO based</b>							
P/E	92.1	66.8	58.8	61.0	54.7	50.0	52.3
P/B	13.5	11.2	9.7	8.5	7.7	6.6	7.2
EV/Sales	26.9	20.9	18.7	20.0	17.7	16.1	16.9
EV/EBITDA	59.3	42.9	37.3	44.3	36.9	33.3	35.1
Dividend yield	0.2%	0.3%	0.5%	0.5%	0.6%	0.7%	0.7%

Source: Company, Bloomberg, BofA Global Research estimates

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### Exhibit 22: UDC – historical valuation multiples based on year-average/high/low share prices

P/E average was 47x during 2019-23 vs high 62x and low 29x (one standard deviation about 15x); thus, our target (55x) shows 0.5 standard deviation above the average

(x)	2016	2017	2018	2019	2020	2021	2022	2023	2019-23 avg
<b>Based on year-avg shr price</b>									
P/E	56.1	51.6	90.7	57.9	62.3	52.7	28.2	34.5	47.1
P/BV	5.1	8.1	7.7	9.9	9.1	8.8	4.6	4.8	7.5
EV/Sales	11.8	14.7	19.5	18.1	17.7	16.0	8.2	10.7	14.2
EV/EBITDA	26.3	28.4	55.2	38.1	38.9	32.9	16.4	23.8	30.0
<b>Based on year-high shr price</b>									
P/E	72.2	86.1	163.9	76.4	85.8	66.9	39.7	43.6	62.5
P/BV	6.6	13.5	14.0	13.0	12.5	11.2	6.5	6.1	9.9
EV/Sales	15.7	25.3	36.9	24.5	25.0	20.8	12.1	13.9	19.2
EV/EBITDA	35.0	49.0	104.5	51.4	55.0	42.6	24.2	30.8	40.8
<b>Based on year-low shr price</b>									
P/E	40.8	25.7	64.4	26.9	38.0	36.4	20.3	25.0	29.3
P/BV	3.7	4.0	5.5	4.6	5.6	6.1	3.3	3.5	4.6
EV/Sales	8.1	6.6	13.2	7.6	10.1	10.6	5.6	7.4	8.3
EV/EBITDA	18.1	12.9	37.5	16.0	22.3	21.8	11.1	16.4	17.5

Source: Company, BofA Global Research

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**Exhibit 23: Valuation comparison among OLED supply-chain companies**

UDC shows relatively higher multiples vs peers due to high margin and long-term growth expectations

Company	Ticker	Rating	Price (Local)	Mcap US\$bn	YTD Return	P/E			P/B			Price/sales		EV/EBITDA		EV/Sales		ROE		Div yield	
						FY23	FY24E	FY25E	FY23	FY24E	FY25E	FY24E	FY25E	FY24E	FY25E	FY24E	FY25E	FY24E	FY25E	FY24E	FY25E
Universal Display	OLED US	B-1-7	187.1	8.9	-2%	44.6	40.4	36.2	6.0	5.3	4.6	13.4	12.2	27.1	24.3	12.8	11.7	14.1%	13.7%	0.9%	1.0%
Duksan Neolux	213420 KS	B-3-9	39,500	0.7	-11%	25.1	25.0	23.1	2.5	2.3	2.1	6.3	5.8	14.7	13.6	4.0	3.7	9.5%	9.3%	0.0%	0.0%
<b>Korea</b>																					
LG Chem	051910 KS	B-1-7	472,000	25.0	-5%	25.0	11.5	9.1	0.7	0.5	0.4	0.6	0.5	4.7	3.4	0.7	0.6	5.4%	5.2%	1.5%	1.9%
Samsung SDI	006400 KS	B-1-8	388,500	20.1	-18%	13.0	15.5	11.6	1.5	1.3	1.2	1.1	0.9	10.1	7.9	1.7	1.5	8.6%	10.3%	0.3%	0.3%
Wonik Materials	104830 KS	nc	30,900	0.3	3%	n/a	13.0	7.5	n/a	0.8	0.8	1.0	0.8	4.4	2.9	0.9	0.7	6.4%	10.4%	2.6%	2.7%
Soulbrain	357780 KS	B-2-8	273,500	1.6	-10%	16.6	14.6	11.0	2.4	2.1	1.8	2.4	2.1	8.7	6.9	2.2	1.9	15.3%	17.4%	0.7%	0.7%
Innox AMC	272290 KS	nc	30,500	0.5	-5%	n/a	10.0	9.2	n/a	1.3	1.2	1.3	1.0	4.8	4.1	1.2	0.9	13.5%	13.1%	n/a	n/a
<b>Japan</b>																					
Tosoh	4042 JP	B-1-7	2,049	4.4	14%	10.5	7.7	6.5	0.9	0.8	0.7	0.6	0.6	4.4	3.9	0.7	0.7	10.5%	11.5%	3.9%	3.9%
Idemitsu Kosan	5019 JP	B-1-7	939	9.3	22%	8.8	8.8	8.6	0.8	0.7	0.6	0.2	0.2	8.8	8.4	0.4	0.4	8.4%	7.5%	3.4%	3.4%
Hodogaya Chem	4112 JP	n/a	3,640	0.2	-2%	10.7	11.6	10.0	0.6	0.6	0.6	0.7	0.6	n/a	n/a	0.8	0.8	5.6%	6.3%	2.1%	2.3%
Sumitomo Chem	4005 JP	B-2-7	313	3.4	-9%	NM	6.2	7.4	0.5	0.4	0.4	0.2	0.2	6.2	5.5	0.6	0.6	7.2%	5.7%	3.8%	3.8%
DNP	7912 JP	nc	4,599	8.9	10%	11.5	13.5	14.6	0.9	1.1	n/a	1.0	0.9	n/a	n/a	0.9	0.9	7.1%	6.6%	1.4%	1.5%
Toppan Printing	7911 JP	nc	3,599	7.9	-9%	14.4	18.8	19.0	0.7	n/a	n/a	0.7	0.7	n/a	n/a	0.6	0.6	4.2%	3.7%	1.3%	1.4%
Asahi Glass	5201 JP	n/a	5,412	7.8	3%	17.2	13.5	10.7	0.8	0.8	0.8	0.6	0.5	5.5	4.9	0.9	0.9	5.9%	7.7%	3.9%	4.1%
Nitto Denko	6988 JP	B-1-7	13,985	13.3	33%	18.9	15.7	14.5	2.1	1.9	1.8	2.2	2.1	8.2	7.6	2.0	1.9	12.7%	12.7%	2.2%	2.4%
Toray	3402 JP	B-3-7	693	7.5	-6%	16.0	13.0	10.6	0.7	0.7	0.6	0.5	0.4	7.5	6.8	0.8	0.7	5.4%	6.3%	2.6%	2.6%
Mitsubishi Chem	4188 JP	B-3-7	863	8.6	0%	9.6	11.6	9.6	0.7	0.7	0.7	0.3	0.3	7.4	6.9	0.9	0.9	6.4%	7.6%	3.7%	3.9%
Nippon Elec. Glass	5214 JP	nc	3,598	2.4	19%	n/a	18.3	17.0	0.6	0.6	0.6	1.2	1.1	7.9	6.8	1.3	1.3	3.6%	3.3%	3.4%	3.6%
<b>US</b>																					
Dupont	DD US	B-3-7	69.9	29.2	-9%	20.1	19.7	17.7	1.2	1.3	1.3	2.4	2.3	13.2	12.5	3.2	3.1	6.3%	7.1%	2.2%	2.3%
Dow Chemical	DOW US	B-1-7	56.0	39.3	2%	24.7	17.2	10.8	2.1	2.1	2.0	0.9	0.8	11.3	9.0	1.6	1.5	12.4%	19.2%	5.0%	5.1%
Merck	MRK GY	A-1-7	157.1	73.9	9%	18.2	17.9	15.9	2.4	2.2	2.0	3.2	3.0	12.5	11.4	3.5	3.3	12.9%	13.4%	1.2%	1.4%
Corning	GLW US	B-1-7	32.7	27.9	7%	19.2	17.6	15.4	2.4	2.3	2.2	2.1	1.9	10.4	10.0	2.9	2.8	13.4%	14.4%	4.0%	4.4%
3M	MMM US	B-2-8	92.2	51.0	-14%	10.0	9.6	9.1	11.2	11.7	9.9	1.6	1.5	8.2	7.9	2.3	2.2	11.8%	110.6%	6.5%	6.5%
<b>Greater China</b>																					
Valiant	002643 CH	nc	14.2	1.8	-14%	n/a	13.2	11.3	n/a	1.7	1.6	2.4	2.1	7.7	6.2	2.5	2.2	13.0%	13.9%	2.3%	2.6%
Puyang Huicheng	300481 CH	nc	13.7	0.6	-22%	n/a	9.9	8.2	n/a	1.5	1.3	n/a	n/a	n/a	n/a	2.2	1.9	14.0%	13.6%	n/a	n/a
Xi'an Manareco	688550 CH	nc	36.1	0.7	-9%	n/a	16.1	15.0	n/a	1.6	1.4	n/a	n/a	n/a	n/a	2.1	1.7	8.6%	9.8%	n/a	n/a
<b>Ex-materials</b>																					
Samsung Elec	005930 KS	A-1-7	72,900	327.0	-7%	34.3	18.4	10.6	1.4	1.3	1.2	1.4	1.3	5.9	4.4	1.5	1.4	7.4%	11.9%	2.0%	2.0%
LX Semicon	108320 KS	B-1-8	79,600	1.0	-8%	n/a	6.9	6.0	n/a	1.1	1.0	0.6	0.6	4.3	3.6	0.5	0.5	16.6%	18.3%	4.4%	4.8%
Applied Materials	AMAT US	B-1-7	199.7	166.2	23%	24.8	24.9	22.1	10.2	8.4	7.0	6.2	5.6	21.7	19.4	6.4	5.8	36.8%	34.1%	0.7%	0.9%
ULVAC	6728 JP	XRVW	9,156	3.0	36%	n/a	n/a	n/a	n/a	n/a	n/a	1.8	1.7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sunic Systems	171090 KS	nc	24,500	0.2	-17%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
KH Vatec	060720 KS	nc	13,470	0.2	-8%	n/a	8.6	6.8	n/a	1.1	0.9	0.7	0.6	3.8	2.7	0.5	0.4	13.1%	13.7%	n/a	n/a

Source: Company, Bloomberg for non-covered (nc) companies, BofA Global Research estimates. ROE = return on equity. Div = dividend.

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**Exhibit 24: UDC – Discounted cash flow (DCF) valuation supports our PO of \$260**

Underlying assumptions: WACC 9.8%, long-term annual sales \$1.0bn+, OP margin 42%+, 35x EV/EBITDA for terminal value

(US\$mn)	2022	2023	2024E	2025E	2026E	2027E	2028E	2029E
Sales	617	576	654	717	824	926	1,000	1,080
OP	267	217	265	297	346	389	422	456
D&A	42	43	49	50	50	50	50	50
EBITDA	309	261	313	347	397	439	472	506
Capex	42	60	60	60	60	60	60	60
Net working capital	186	284	256	270	275	280	285	290
Change in NWC	111	98	-28	14	5	5	5	5
Taxes	58	42	64	70	76	86	93	100
<b>Free cash flow</b>	<b>98</b>	<b>60</b>	<b>217</b>	<b>204</b>	<b>255</b>	<b>289</b>	<b>315</b>	<b>341</b>
Sales growth	11%	-7%	14%	10%	15%	12%	8%	8%
OP margin	43%	38%	40%	41%	42%	42%	42%	42%
Capex growth	-33%	40%	40%	7%	0%	0%	0%	0%
<b>Discount factor</b>			0.91	0.83	0.76	0.69	0.63	0.57
PV of annual FCF			198	169	193	199	197	195
<b>PV of 2023-28 FCF (a)</b>		<b>1,150</b>						
<b>PV of post 2028 value (b)</b>		<b>10,108</b>						
35x EV/EBITDA								17,712
<b>Enterprise value (a+b)</b>		<b>11,258</b>						
Net cash (2023-end)		1,113						
<b>Shareholder value</b>		<b>12,371</b>						
<b>DCF FV per share</b>		<b>260.1</b>						
<b>PO</b>		<b>260.0</b>						
Current share price		187						

Note: net cash includes cash & cash equivalents, short-term and long-term investments

Source: Company, BofA Global Research estimates

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**Exhibit 25: UDC – Income statement**

Back to upcycle in 2024-26E; +10% CAGR in 2023-26 revenue and proven high margin profile sustainable (GM 77%+; OPM 40%+)

US\$mnn	1Q23	2Q23	3Q23	4Q23	1Q24E	2Q24E	3Q24E	4Q24E	2019	2020	2021	2022	2023	2024E	2025E	2026E
<b>Sales</b>	<b>130.5</b>	<b>146.6</b>	<b>141.1</b>	<b>158.3</b>	<b>150.9</b>	<b>160.7</b>	<b>165.4</b>	<b>177.4</b>	<b>405.2</b>	<b>428.9</b>	<b>553.5</b>	<b>616.6</b>	<b>576.4</b>	<b>654.4</b>	<b>716.7</b>	<b>767.8</b>
Cost of goods sold	33.0	32.1	34.2	36.0	35.2	36.3	37.2	39.0	85.9	92.1	115.0	127.9	135.4	147.7	159.9	173.3
<b>Gross profit</b>	<b>97.5</b>	<b>114.4</b>	<b>106.8</b>	<b>122.3</b>	<b>115.6</b>	<b>124.4</b>	<b>128.2</b>	<b>138.4</b>	<b>319.3</b>	<b>336.8</b>	<b>438.5</b>	<b>488.7</b>	<b>441.1</b>	<b>506.6</b>	<b>556.7</b>	<b>594.5</b>
Operating expenses	52.1	55.8	58.4	57.6	56.3	59.7	63.1	62.7	160.9	179.3	210.9	221.6	223.9	241.8	259.9	279.5
R&D	31.4	32.3	33.1	33.6	34.0	34.3	34.7	35.0	71.3	83.9	99.7	115.9	130.5	138.0	143.6	149.4
<b>Operating profit</b>	<b>45.4</b>	<b>58.6</b>	<b>48.4</b>	<b>64.7</b>	<b>59.3</b>	<b>64.7</b>	<b>65.2</b>	<b>75.6</b>	<b>158.3</b>	<b>157.5</b>	<b>227.6</b>	<b>267.1</b>	<b>217.2</b>	<b>264.8</b>	<b>296.8</b>	<b>315.0</b>
Non-operating income	6.3	5.4	5.4	10.9	6.9	6.8	6.2	5.9	11.6	6.0	0.6	1.1	28.0	25.8	21.1	21.1
Net financial income	7.0	6.2	7.1	7.9	7.0	6.9	6.3	6.0	10.8	5.1	0.5	7.8	28.2	26.2	21.5	21.5
Interest income	7.0	6.2	7.1	7.9	7.0	6.9	6.3	6.0	10.8	5.1	0.5	7.8	28.2	26.2	21.5	21.5
Interest expense	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other non-operating income	-0.7	-0.8	-1.7	3.0	-0.1	-0.1	-0.1	-0.1	0.8	0.9	0.1	-6.7	-0.2	-0.4	-0.4	-0.4
<b>Pre-tax income</b>	<b>51.6</b>	<b>64.1</b>	<b>53.9</b>	<b>75.6</b>	<b>66.2</b>	<b>71.5</b>	<b>71.4</b>	<b>81.5</b>	<b>169.9</b>	<b>163.5</b>	<b>228.2</b>	<b>268.2</b>	<b>245.2</b>	<b>290.6</b>	<b>317.9</b>	<b>336.1</b>
Income taxes	11.8	14.4	2.4	13.6	14.6	15.7	15.7	17.9	31.6	30.2	44.0	58.2	42.0	63.9	69.9	74.0
<b>Net income</b>	<b>39.8</b>	<b>49.7</b>	<b>51.5</b>	<b>62.0</b>	<b>51.7</b>	<b>55.8</b>	<b>55.7</b>	<b>63.6</b>	<b>138.3</b>	<b>133.4</b>	<b>184.2</b>	<b>210.1</b>	<b>203.0</b>	<b>226.7</b>	<b>247.9</b>	<b>262.2</b>
<b>Diluted EPS (US\$)</b>	<b>0.8</b>	<b>1.0</b>	<b>1.1</b>	<b>1.3</b>	<b>1.1</b>	<b>1.2</b>	<b>1.2</b>	<b>1.3</b>	<b>2.9</b>	<b>2.8</b>	<b>3.9</b>	<b>4.4</b>	<b>4.3</b>	<b>4.8</b>	<b>5.2</b>	<b>5.5</b>
DPS	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.8	1.2	1.4	1.6	1.8	2.0
Dividend payout (%)	8%	8%	8%	8%	9%	9%	8%	8%	14%	21%	21%	27%	33%	34%	35%	36%
<b>Margins</b>																
<b>Gross margin</b>	<b>75%</b>	<b>78%</b>	<b>76%</b>	<b>77%</b>	<b>77%</b>	<b>77%</b>	<b>78%</b>	<b>78%</b>	<b>79%</b>	<b>79%</b>	<b>79%</b>	<b>79%</b>	<b>77%</b>	<b>77%</b>	<b>78%</b>	<b>77%</b>
<b>Operating margin</b>	<b>35%</b>	<b>40%</b>	<b>34%</b>	<b>41%</b>	<b>39%</b>	<b>40%</b>	<b>39%</b>	<b>43%</b>	<b>39%</b>	<b>37%</b>	<b>41%</b>	<b>43%</b>	<b>38%</b>	<b>40%</b>	<b>41%</b>	<b>41%</b>
Effective tax rate	23%	22%	4%	18%	22%	22%	22%	22%	19%	18%	19%	22%	17%	22%	22%	22%
Net margin	31%	34%	37%	39%	34%	35%	34%	36%	34%	31%	33%	34%	35%	35%	35%	34%
<b>ROE (%)</b>	<b>12%</b>	<b>15%</b>	<b>15%</b>	<b>18%</b>	<b>14%</b>	<b>15%</b>	<b>15%</b>	<b>16%</b>	<b>18%</b>	<b>15%</b>	<b>18%</b>	<b>18%</b>	<b>15%</b>	<b>15%</b>	<b>14%</b>	<b>13%</b>

Source: Company, BofA Global Research estimates. ROE = return on equity.

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**Exhibit 26: UDC – Sales breakdown**

Materials account for 50%+ of total sales vs royalty/license fees 40%+/-; assumed minimal contribution of blue color materials until 3Q24 to be conservative

	1Q23	2Q23	3Q23	4Q23	1Q24E	2Q24E	3Q24E	4Q24E	2019	2020	2021	2022	2023	2024E	2025E	2026E
<b>Sales (US\$mnn)</b>																
<b>Material sales</b>	<b>70.2</b>	<b>77.1</b>	<b>92.5</b>	<b>82.2</b>	<b>86.6</b>	<b>92.7</b>	<b>98.6</b>	<b>103.0</b>	<b>243.4</b>	<b>229.7</b>	<b>318.6</b>	<b>331.1</b>	<b>322.0</b>	<b>380.9</b>	<b>424.0</b>	<b>460.6</b>
Red emitter	16.1	16.7	22.1	18.3	20.0	20.0	24.0	25.0	53.2	50.9	75.2	79.0	73.2	89.0	99.0	108.9
Green emitter	53.8	58.0	68.9	62.5	65.0	70.0	71.6	73.0	189.5	177.9	243.4	251.8	243.2	279.6	295.0	315.7
Blue emitter	0.3	2.4	1.5	1.4	1.6	2.7	3.0	5.0	0.0	0.0	0.0	0.3	5.6	12.3	30.0	36.0
<b>Royalty and license fees</b>	<b>55.2</b>	<b>64.4</b>	<b>45.9</b>	<b>72.9</b>	<b>59.0</b>	<b>62.7</b>	<b>64.0</b>	<b>71.0</b>	<b>150.0</b>	<b>185.1</b>	<b>219.0</b>	<b>267.1</b>	<b>238.4</b>	<b>256.7</b>	<b>275.0</b>	<b>288.8</b>
Contract research services	5.1	5.1	2.7	3.2	5.3	5.3	2.8	3.4	11.7	14.1	15.9	18.4	16.0	16.8	17.7	18.5
<b>Total revenue</b>	<b>130.5</b>	<b>146.6</b>	<b>141.1</b>	<b>158.3</b>	<b>150.9</b>	<b>160.7</b>	<b>165.4</b>	<b>177.4</b>	<b>405.2</b>	<b>428.9</b>	<b>553.5</b>	<b>616.6</b>	<b>576.4</b>	<b>654.4</b>	<b>716.7</b>	<b>767.8</b>
<b>QoQ %</b>																
Material sales	-21%	10%	20%	-11%	5%	7%	6%	4%								
Red emitter	-25%	4%	32%	-17%	9%	0%	20%	4%								
Green emitter	-19%	8%	19%	-9%	4%	8%	2%	2%								
Royalty and license fees	-27%	17%	-29%	59%	-19%	6%	2%	11%								
Contract research services	-1%	0%	-47%	20%	65%	0%	-47%	20%								
<b>Total revenue</b>	<b>-23%</b>	<b>12%</b>	<b>-4%</b>	<b>12%</b>	<b>-5%</b>	<b>7%</b>	<b>3%</b>	<b>7%</b>								
<b>YoY %</b>																
Material sales	-19%	7%	10%	-7%	23%	20%	7%	25%	59%	-6%	39%	4%	-3%	18%	11%	9%
Red emitter	-20%	-3%	11%	-15%	24%	20%	9%	37%	17%	-4%	48%	5%	-7%	22%	11%	10%
Green emitter	-19%	6%	7%	-6%	21%	21%	4%	17%	77%	-6%	37%	3%	-3%	15%	6%	7%
Royalty and license fees	-8%	7%	-36%	-4%	7%	-3%	39%	-3%	86%	23%	18%	22%	-11%	8%	7%	5%
Contract research services	27%	15%	-46%	-37%	5%	5%	5%	5%	-13%	20%	13%	16%	-13%	5%	5%	5%
<b>Total revenue</b>	<b>-13%</b>	<b>7%</b>	<b>-12%</b>	<b>-6%</b>	<b>16%</b>	<b>10%</b>	<b>17%</b>	<b>12%</b>	<b>64%</b>	<b>6%</b>	<b>29%</b>	<b>11%</b>	<b>-7%</b>	<b>14%</b>	<b>10%</b>	<b>7%</b>
<b>Sales mix</b>																
Material sales	54%	53%	66%	52%	57%	58%	60%	58%	60%	54%	58%	54%	56%	58%	59%	60%
Red emitter	12%	11%	16%	12%	13%	12%	15%	14%	13%	12%	14%	13%	13%	14%	14%	14%
Green emitter	41%	40%	49%	39%	43%	44%	43%	41%	47%	41%	44%	41%	42%	43%	41%	41%
Royalty and license fees	42%	44%	33%	46%	39%	39%	39%	40%	37%	43%	40%	43%	41%	39%	38%	38%
Contract research services	4%	3%	2%	2%	4%	3%	2%	2%	3%	3%	3%	3%	3%	3%	2%	2%
<b>Total revenue</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Source: Company, BofA Global Research estimates

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**Exhibit 27: UDC – Balance sheet**

Strong balance sheet with net-cash position (US\$0.8bn as of 4Q23)

US\$m	1Q23	2Q23	3Q23	4Q23	1Q24E	2Q24E	3Q24E	4Q24E	2019	2020	2021	2022	2023	2024E	2025E	2026E
Cash and cash equivalents	158	93	79	92	93	124	170	203	132	630	312	93	92	203	369	544
Short-term investments	488	466	412	422	433	439	461	466	514	100	351	484	422	466	514	535
Account receivables	93	109	122	140	120	115	125	123	60	82	108	93	140	123	129	136
Inventories	174	176	181	176	171	175	180	175	64	92	134	183	176	175	184	193
Other current assets	37	34	83	87	87	87	87	87	22	21	21	46	87	87	87	87
<b>Total current assets</b>	<b>950</b>	<b>878</b>	<b>879</b>	<b>917</b>	<b>904</b>	<b>940</b>	<b>1,024</b>	<b>1,054</b>	<b>792</b>	<b>925</b>	<b>926</b>	<b>899</b>	<b>917</b>	<b>1,054</b>	<b>1,283</b>	<b>1,494</b>
Net PP&E	145	158	175	175	175	183	190	198	96	111	129	143	175	198	226	252
Intangible assets	8	8	7	7	7	7	7	7	103	81	10	8	7	7	7	7
Goodwill	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
LT investments	213	211	301	300	301	303	304	306	5	5	168	260	300	306	312	318
Deferred income taxes	63	70	50	59	59	59	59	59	30	38	33	58	59	59	59	59
Other non-current assets	140	200	196	196	196	196	196	196	78	95	185	148	196	196	196	196
<b>Non-current assets</b>	<b>950</b>	<b>878</b>	<b>879</b>	<b>917</b>	<b>904</b>	<b>940</b>	<b>1,024</b>	<b>1,054</b>	<b>792</b>	<b>925</b>	<b>926</b>	<b>899</b>	<b>917</b>	<b>1,054</b>	<b>1,283</b>	<b>1,494</b>
<b>Total assets</b>	<b>1,536</b>	<b>1,541</b>	<b>1,623</b>	<b>1,669</b>	<b>1,658</b>	<b>1,703</b>	<b>1,795</b>	<b>1,835</b>	<b>1,120</b>	<b>1,269</b>	<b>1,467</b>	<b>1,533</b>	<b>1,669</b>	<b>1,835</b>	<b>2,098</b>	<b>2,341</b>
Account payables	10	7	21	11	13	15	17	19	13	14	15	10	11	19	20	20
Short-term borrowings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deferred revenue	37	30	67	48	47	47	46	46	97	105	121	46	48	46	44	42
Other current liabilities	42	9	5	8	10	10	10	10	2	5	7	30	8	10	10	10
<b>Total current liabilities</b>	<b>115</b>	<b>81</b>	<b>131</b>	<b>119</b>	<b>123</b>	<b>125</b>	<b>127</b>	<b>129</b>	<b>162</b>	<b>165</b>	<b>188</b>	<b>136</b>	<b>119</b>	<b>129</b>	<b>130</b>	<b>131</b>
Long-term borrowings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deferred revenue	18	18	9	12	8	8	8	8	48	57	36	18	12	8	8	8
Other non-current liabilities	43	42	39	39	40	40	40	40	49	56	76	44	39	40	40	40
<b>Total non-current liabilities</b>	<b>121</b>	<b>121</b>	<b>109</b>	<b>103</b>	<b>101</b>	<b>101</b>	<b>101</b>	<b>101</b>	<b>147</b>	<b>192</b>	<b>179</b>	<b>122</b>	<b>103</b>	<b>101</b>	<b>102</b>	<b>103</b>
<b>Total liabilities</b>	<b>236</b>	<b>202</b>	<b>241</b>	<b>222</b>	<b>223</b>	<b>226</b>	<b>228</b>	<b>230</b>	<b>309</b>	<b>357</b>	<b>367</b>	<b>257</b>	<b>222</b>	<b>230</b>	<b>233</b>	<b>234</b>
Paid-in capital (common stock)	679	687	694	700	700	700	700	700	619	635	659	681	700	700	700	700
Retained earnings	676	709	744	790	822	859	895	940	249	354	500	653	790	940	1,102	1,269
Others	-56	-57	-56	-42	-87	-81	-28	-35	-57	-76	-59	-59	-42	-35	63	138
<b>Total shareholder's equity</b>	<b>1,299</b>	<b>1,339</b>	<b>1,382</b>	<b>1,447</b>	<b>1,434</b>	<b>1,477</b>	<b>1,567</b>	<b>1,604</b>	<b>811</b>	<b>913</b>	<b>1,100</b>	<b>1,275</b>	<b>1,447</b>	<b>1,604</b>	<b>1,865</b>	<b>2,107</b>
<b>BVPS (US\$)</b>	<b>27.3</b>	<b>28.1</b>	<b>29.1</b>	<b>30.4</b>	<b>30.1</b>	<b>31.1</b>	<b>32.9</b>	<b>33.7</b>	<b>17.3</b>	<b>19.3</b>	<b>23.2</b>	<b>26.9</b>	<b>30.4</b>	<b>33.7</b>	<b>39.2</b>	<b>44.3</b>
Gross debt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross debt/equity (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>Net debt</b>	<b>-859</b>	<b>-771</b>	<b>-793</b>	<b>-814</b>	<b>-827</b>	<b>-865</b>	<b>-936</b>	<b>-974</b>	<b>-651</b>	<b>-735</b>	<b>-831</b>	<b>-838</b>	<b>-814</b>	<b>-974</b>	<b>-1,195</b>	<b>-1,397</b>
Net debt/equity (%)	-66%	-58%	-57%	-56%	-58%	-59%	-60%	-61%	-80%	-81%	-76%	-66%	-56%	-61%	-64%	-66%

Source: Company, BofA Global Research estimates

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**Exhibit 28: UDC – Cash flow statement**

Robust FCF generation likely to continue in 2024-26E thanks to high EBITDA (\$300mn+) and low capex spend (\$60mn)

US\$m	1Q23	2Q23	3Q23	4Q23	1Q24E	2Q24E	3Q24E	4Q24E	2019	2020	2021	2022	2023	2024E	2025E	2026E
Net income	40	50	52	62	52	56	56	64	138	133	184	210	203	227	248	262
Depreciation	6	7	7	7	7	8	8	8	12	15	20	25	27	31	32	35
Amortization	3	4	5	5	5	5	5	5	22	22	22	17	16	18	18	18
Changes in working capital	3	49	17	28	-29	-3	13	-9	-1	45	45	111	98	-28	14	15
Others	-5	-100	-20	-65	0	0	0	0	23	-67	-80	-237	-190	0	0	0
<b>Cash flow from operating activities</b>	<b>48</b>	<b>10</b>	<b>60</b>	<b>37</b>	<b>35</b>	<b>65</b>	<b>81</b>	<b>67</b>	<b>194</b>	<b>149</b>	<b>191</b>	<b>127</b>	<b>155</b>	<b>247</b>	<b>312</b>	<b>330</b>
Capital expenditure	-9	-18	-25	-8	-15	-15	-15	-15	-30	-28	-43	-42	-60	-60	-60	-60
Others	50	-40	-33	0	0	0	0	0	-209	419	-415	-238	-24	0	0	0
<b>Cash flow from investing activities</b>	<b>41</b>	<b>-58</b>	<b>-58</b>	<b>-8</b>	<b>-15</b>	<b>-15</b>	<b>-15</b>	<b>-15</b>	<b>-239</b>	<b>391</b>	<b>-458</b>	<b>-281</b>	<b>-83</b>	<b>-60</b>	<b>-60</b>	<b>-60</b>
Stock issuance	1	0	1	0	0	0	0	0	0	1	1	2	2	0	0	0
Dividends	-17	-17	-17	-17	-19	-19	-19	-19	-19	-28	-38	-57	-67	-76	-86	-95
Others	-7	0	0	0	0	0	0	0	-16	-14	-15	-9	-8	0	0	0
<b>Cash flow from financing activities</b>	<b>-23</b>	<b>-16</b>	<b>-17</b>	<b>-16</b>	<b>-19</b>	<b>-19</b>	<b>-19</b>	<b>-19</b>	<b>-35</b>	<b>-42</b>	<b>-51</b>	<b>-65</b>	<b>-73</b>	<b>-76</b>	<b>-86</b>	<b>-95</b>
FX effect	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in cash	65	-65	-14	13	1	31	47	33	-79	498	-318	-219	-1	111	166	175
<b>Cash at beginning of period</b>	<b>93</b>	<b>158</b>	<b>93</b>	<b>79</b>	<b>92</b>	<b>93</b>	<b>124</b>	<b>170</b>	<b>211</b>	<b>132</b>	<b>630</b>	<b>312</b>	<b>93</b>	<b>92</b>	<b>203</b>	<b>369</b>
Adjustments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Cash at end of period</b>	<b>158</b>	<b>93</b>	<b>79</b>	<b>92</b>	<b>93</b>	<b>124</b>	<b>170</b>	<b>203</b>	<b>132</b>	<b>630</b>	<b>312</b>	<b>93</b>	<b>92</b>	<b>203</b>	<b>369</b>	<b>544</b>
<b>Adjusted FCF</b>																
Sales	130	147	141	158	151	161	165	177	405	429	554	617	576	654	717	768
OP	45	59	48	65	59	65	65	76	158	158	228	267	217	265	297	315
Dep/amort	9	11	11	12	12	12	12	12	34	37	42	42	43	49	50	53
<b>EBITDA</b>	<b>55</b>	<b>69</b>	<b>60</b>	<b>77</b>	<b>71</b>	<b>77</b>	<b>77</b>	<b>88</b>	<b>193</b>	<b>195</b>	<b>270</b>	<b>309</b>	<b>261</b>	<b>313</b>	<b>347</b>	<b>368</b>
Capex	9	18	25	8	15	15	15	15	30	28	43	42	60	60	60	60
NWC increase	3	49	17	28	-29	-3	13	-9	-1	45	45	111	98	-28	14	15
Tax	12	14	2	14	15	16	16	18	32	30	44	58	42	64	70	74
<b>FCF</b>	<b>31</b>	<b>-12</b>	<b>15</b>	<b>27</b>	<b>70</b>	<b>49</b>	<b>34</b>	<b>64</b>	<b>133</b>	<b>92</b>	<b>137</b>	<b>98</b>	<b>60</b>	<b>217</b>	<b>204</b>	<b>219</b>
<b>Adj FCF ex NWC impact</b>	<b>34</b>	<b>37</b>	<b>33</b>	<b>55</b>	<b>42</b>	<b>46</b>	<b>47</b>	<b>55</b>	<b>131</b>	<b>137</b>	<b>182</b>	<b>209</b>	<b>159</b>	<b>189</b>	<b>217</b>	<b>234</b>

Source: Company, BofA Global Research estimates

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## Price objective basis & risk

### Universal Display (OLED)

Our PO of \$260 is derived from 55x 2024E P/E, which is nearly high-teens% (0.5 standard deviation) above the 2019-23 average (47x vs high of 63x and low of 29x). Display industry downturn (valuation discount factor) is less of a concern. We expect 12% EPS growth in 2024 (vs -4% in 2023). The P/E usually stays at 50-60x along with 10%+ EPS growth outlook (12-month forward basis), as evident from the 2020-21 upturn period.

Upside risks are blue (official announcement on commercialization), Apple (mass supply of new iPad/MacBook using OLED display), and new fabs (acceleration of new capacity expansion led by Samsung Electronics, LG Display, BOE, etc.).

Downside risks are mostly related to weaker tech demand (smartphone, PC, TV), or slower progress in blue commercialization, new iPad introduction, and OLED fab capacity expansion.

## Analyst Certification

We, Simon Woo, CFA and Matt Shin, hereby certify that the views each of us has expressed in this research report accurately reflect each of our respective personal views about the subject securities and issuers. We also certify that no part of our respective compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

### APR - Technology Hardware Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
<b>BUY</b>				
	Asustek	AKCPF	2357 TT	Robert Cheng
	BOE Technology Group Co., Ltd	XCJQF	000725 CH	Brad Lin
	BYD Electronic	BYDIF	285 HK	Katherine Zhu
	Crystal-Optech	XMKAF	002273 CH	Katherine Zhu
	Delta Electronics Inc.	DLTEF	2308 TT	Robert Cheng
	DS Precision	XBASF	002384 CH	Mike Yang
	Elite Material	ETMCF	2383 TT	Mike Yang
	Foxconn Industrial Internet	XDAZF	601138 CH	Robert Cheng
	Gold Circuit	GOCCF	2368 TT	Doris Kao
	Inovance Technology	XMYRF	300124 CH	Ming Hsun Lee, CFA
	Largan Precision	LGANF	3008 TT	Robert Cheng
	LG Electronics	LGEAF	066570 KS	Simon Woo, CFA
	LG Innotek	XLGQF	011070 KS	Simon Woo, CFA
	Lianchuang Electronic	XWOFF	002036 CH	Katherine Zhu
	Lite-On Tech	LOTZF	2301 TT	Doris Kao
	Lotes	ZYZTF	3533 TT	Doris Kao
	Luxshare	XNJQF	002475 CH	Robert Cheng
	Quanta Computer	QUCPF	2382 TT	Robert Cheng
	Samsung Electro-Mechanics	SMSGF	009150 KS	Simon Woo, CFA
	Samsung SDI	SSDIF	006400 KS	Simon Woo, CFA
	Samsung SDS	XWPBF	018260 KS	Simon Woo, CFA
	Shennan Circuits	XAMKF	002916 CH	Doris Kao
	Transsion	XCINF	688036 CH	Robert Cheng
	Unimicron	UMCRF	3037 TT	Mike Yang
	Universal Display	OLED	OLED US	Simon Woo, CFA
	Wistron	WICOF	3231 TT	Doris Kao
	Wiwynn	XWIQF	6669 TT	Robert Cheng
	Zhongji Innolight	XZICF	300308 CH	Katherine Zhu
<b>NEUTRAL</b>				
	AU Optronics	AUOTF	2409 TT	Brad Lin
	AU Optronics	AUOTY	AUOTY US	Brad Lin
	E Ink Holdings	PVWIF	8069 TT	Doris Kao

**APR - Technology Hardware Coverage Cluster**

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
	Ennostar	XENOF	3714 TT	Katherine Zhu
	Everwin Precision	XSHZF	300115 CH	Katherine Zhu
	Hon Hai Precision Industry	HNHAF	2317 TT	Robert Cheng
	Innolux Corporation	CMLXY	3481 TT	Brad Lin
	Lenovo Group	LNVGf	992 HK	Robert Cheng
	Lenovo Group	LNVGy	LNVGy US	Robert Cheng
	NYP CB	NANYF	8046 TT	Mike Yang
	Sunny Optical	SNPTF	2382 HK	Katherine Zhu
	TCL Technology Group Corp	XTOOF	000100 CH	Brad Lin
	Xiaomi Corporation	XIACF	1810 HK	Robert Cheng
	Yageo	YGEQF	2327 TT	Robert Cheng
	Zhen Ding Tech	XFAGF	4958 TT	Doris Kao
	ZTE Corporation	SHZZF	000063 CH	Katherine Zhu
	ZTE Corporation	ZTCOF	763 HK	Katherine Zhu

**UNDERPERFORM**

	AAC Technologies	AACAF	2018 HK	Katherine Zhu
	Acer	ASIYF	2353 TT	Robert Cheng
	Advantech	ADTEF	2395 TT	Robert Cheng
	BizLink	BIZLF	3665 TT	Doris Kao
	Catcher Tech	CHERF	2474 TT	Robert Cheng
	Compal Electron	XLCPF	2324 TT	Doris Kao
	Duksan Neolux	XDSXF	213420 KS	Simon Woo, CFA
	Genius Electronic Optical	GNSEF	3406 TT	Robert Cheng
	Goertek	XGKCF	002241 CH	Robert Cheng
	Kinsus	KNSUF	3189 TT	Mike Yang
	LG Display	LPHLF	034220 KS	Simon Woo, CFA
	LG Display-ADR	LPL	LPL US	Simon Woo, CFA
	Pegatron	PGTRF	4938 TT	Robert Cheng
	Sanan Opto	XEQYF	600703 CH	Katherine Zhu
	Seoul Semiconductor	SLSOF	046890 KS	Simon Woo, CFA
	Shengyi	DGUNF	600183 CH	Mike Yang
	Sunway Communications	XWSVF	300136 CH	Robert Cheng
	Tianma	XVZLF	000050 CH	Brad Lin

**iQmethod<sup>SM</sup> Measures Definitions****Business Performance**

Return On Capital Employed

Return On Equity  
Operating Margin  
Earnings Growth  
Free Cash Flow

**Numerator**

NOPAT = (EBIT + Interest Income) × (1 – Tax Rate) + Goodwill Amortization

Net Income  
Operating Profit  
Expected 5 Year CAGR From Latest Actual  
Cash Flow From Operations – Total Capex

**Denominator**

Total Assets – Current Liabilities + ST Debt + Accumulated Goodwill  
Amortization  
Shareholders' Equity  
Sales  
N/A  
N/A

**Quality of Earnings**

Cash Realization Ratio  
Asset Replacement Ratio  
Tax Rate  
Net Debt-To-Equity Ratio  
Interest Cover

**Numerator**

Cash Flow From Operations  
Capex  
Tax Charge  
Net Debt = Total Debt – Cash & Equivalents  
EBIT

**Denominator**

Net Income  
Depreciation  
Pre-Tax Income  
Total Equity  
Interest Expense

**Valuation Toolkit**

Price / Earnings Ratio  
Price / Book Value  
Dividend Yield  
Free Cash Flow Yield  
Enterprise Value / Sales

**Numerator**

Current Share Price  
Current Share Price  
Annualised Declared Cash Dividend  
Cash Flow From Operations – Total Capex  
EV = Current Share Price × Current Shares + Minority Equity + Net Debt + Other LT Liabilities  
Enterprise Value

**Denominator**

Diluted Earnings Per Share (Basis As Specified)  
Shareholders' Equity / Current Basic Shares  
Current Share Price  
Market Cap = Current Share Price × Current Basic Shares  
Sales

EV / EBITDA

Basic EBIT + Depreciation + Amortization

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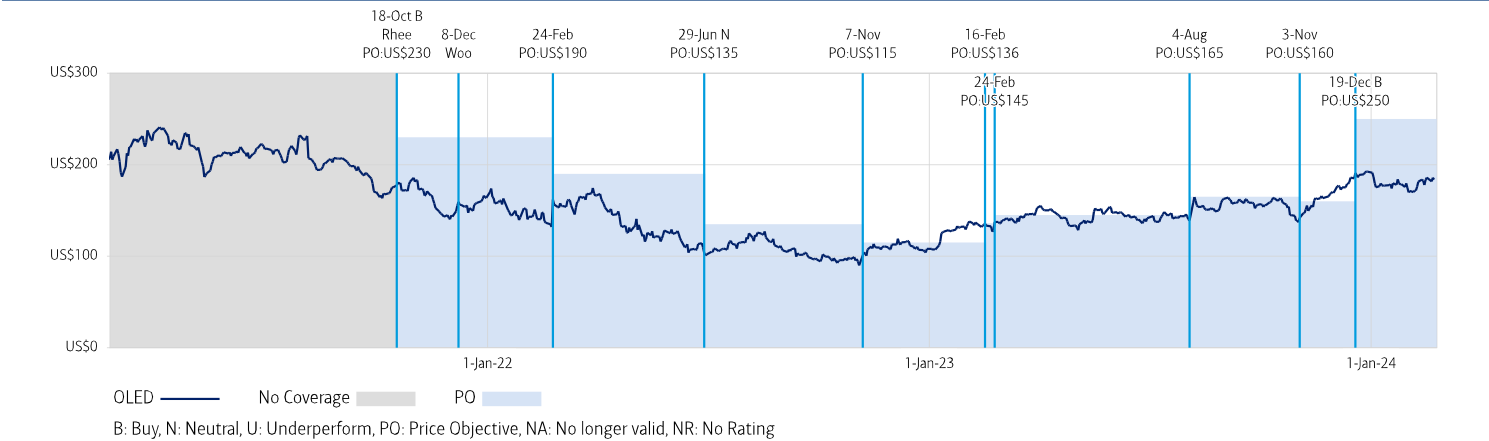




# Disclosures

## Important Disclosures

Universal Display (OLED) Price Chart



The Investment Opinion System is contained at the end of the report under the heading "Fundamental Equity Opinion Key". Dark grey shading indicates the security is restricted with the opinion suspended. Medium grey shading indicates the security is under review with the opinion withdrawn. Light grey shading indicates the security is not covered. Chart is current as of a date no more than one trading day prior to the date of the report.

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

Coverage Universe	Count	Percent	Inv. Banking Relationships <sup>R1</sup>	Count	Percent
Buy	215	53.09%	Buy	111	51.63%
Hold	97	23.95%	Hold	45	46.39%
Sell	93	22.96%	Sell	24	25.81%

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

Coverage Universe	Count	Percent	Inv. Banking Relationships <sup>R1</sup>	Count	Percent
Buy	1895	53.62%	Buy	1083	57.15%
Hold	832	23.54%	Hold	454	54.57%
Sell	807	22.84%	Sell	383	47.46%

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

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

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