

Global Semiconductors

Industrial, auto semis: despite growth, more defensive than offensive

Industry Overview

Review of \$145bn “analog” chips exposed to megatrends

We examine the last five years of sales, profitability and stock market performance of the top 8 diversified chipmakers exposed to cyclical industrial and auto end markets incl. Texas Ins., Analog Devices, NXP Semi, Microchip, Infineon, STMicro, Renesas and Onsemi. These leaders of the \$144.5bn analog, microcontroller (MCU) and power discretes semis industry offer: 1) attractive exposure to secular megatrends in industrial automation, renewable energy, vehicle electrification, cloud infrastructure, aerospace, defense and medical instrumentation, 2) diversification away from the AI theme that is driving the majority of other chipmakers, and 3) attractive FCF generation/returns.

Diversified semis outgrew semis, but mostly due to pricing

Per SIA data: 1) Total diversified sales across analog, MCU, discretes totaled around \$144.5bn in CY23, growing at a healthy 7.6% CAGR from CY18, accounting for about 27% of The \$527bn total semi industry sales; 2) Over the past 5/10/15 years, diversified semis grew at a 7.6%, 7.1% and 5.3% CAGR, outgrowing all semis that were up at a 2.4%/5.6%/5.1% CAGR. Even ex memory where CY22/23 was exceptionally weak, diversified semis outgrew core (ex-memory) semis by ~100bps; 3) Among diversified semis, MCU sales were the smallest segment at just \$27.9bn in CY23 sales, but grew the fastest over the past five years at a 10.3% CAGR, followed by power discretes that grew at a 8% CAGR to \$35.5bn, and then the largest analog segment that grew at a 6.7% CAGR to \$81.1bn; though interestingly 4) majority of diversified sales growth in past 5 years came from pricing that grew at a 7.5% pace while units grew only at a 0.2% CAGR.

But...despite outgrowth, diversified semis lagged SOX

Despite superior sales, diversified semi have consistently underperformed the SOX index that has been driven more by data center/AI and semicap stocks. Over the 5 years, diversified chipmaker stocks appreciated by 19% annually on an average, well-below the 30% annual SOX returns, though better than 15% annual returns of the S&P 500 index and 12% annual of just the S&P 500 Industrials. While there are some stock-specific exceptions, the trend shows diversified semis relatively outperform only when the SOX declines, such as in CY22 or CY15, i.e. they tend to more defensive.

Auto semis “offensive” while industrials more “defensive”

Within the diversified stocks, generally those exposed to more auto sales (stronger content expansion theme) have tended to outperform those with higher industrial exposure (less content expansion, more cyclical). Industrial semis (TXN, ADI, MCHP) tend to have higher FCF generation/returns that provides a stock cushion during downturns, though lower content growth industrial markets limit their outperformance in stronger periods for the SOX. Auto semis provide more a content expansion theme driven by secular tailwinds around increasing electrification and driver assist systems, coupled with stronger pricing trends among higher MCU exposure for auto semis.

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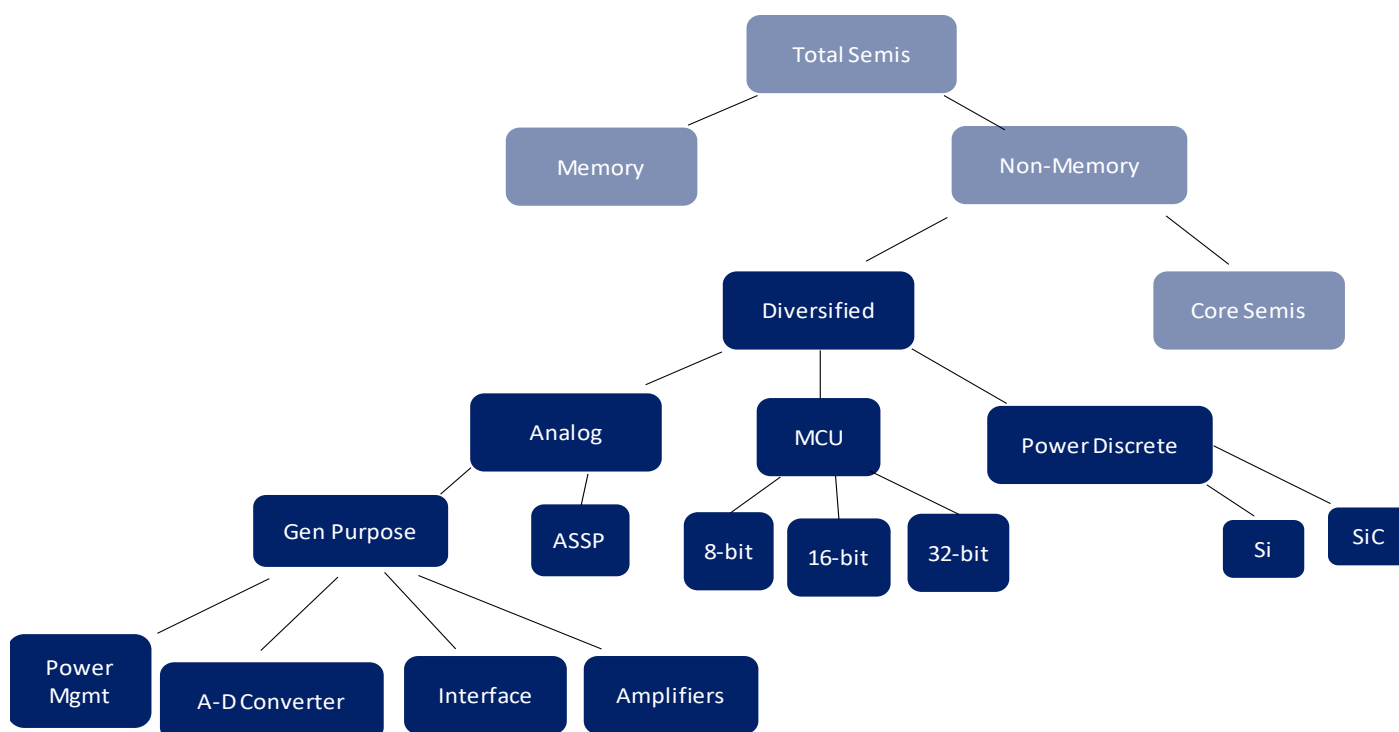
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Diversified semis outgrew industry

We examine the market for analog, microcontroller (MCU) and power discrete semis – collectively referred to as “diversified semis - that delivered around \$144.5bn in CY23 sales, per SIA, growing at a strong 7.6% compounded annual pace (CAGR) for the past 5 (CY18-23), 7.1% over the past ten (CY13-23) and 5.3% CAGR over the past 15 years (CY08-23). Across each of these timeframes diversified semi sales outgrow total semis and core (ex-memory) semis, driven by stronger demand and pricing for indus/auto.

Exhibit 1: Semis landscape overview

Diversified semis consist of Analog, MCU, and Power Discrete device categories



Source: BofA Global Research

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Exhibit 2: Diversified semis outgrew overall and core (ex-memory) semis for the past 5, 10, 15 yr periods

Annual and compounded annual sales trends for analog, MCU, discrete semis versus total industry and core semis

Sales (\$mn)	CY18	CY19	CY20	CY21	CY22	CY23	CAGR		
							5-yr	10-yr	15-yr
Total Semiconductors	\$468,778	\$412,307	\$440,389	\$555,893	\$573,683	\$526,828	2.4%	5.6%	5.1%
YoY	13.7%	-12.0%	6.8%	26.2%	3.2%	-8.2%			
Memory Semis	\$157,967	\$106,440	\$117,482	\$153,838	\$129,801	\$92,309	-10.2%	3.2%	4.7%
YoY	27.4%	-32.6%	10.4%	30.9%	-15.6%	-28.9%			
Core Semis (Ex Memory)	\$310,812	\$305,867	\$322,907	\$402,054	\$443,882	\$434,518	6.9%	6.2%	5.2%
YoY	7.8%	-1.6%	5.6%	24.5%	10.4%	-2.1%			
Including Diversified Semis	\$99,956	\$93,628	\$94,946	\$124,065	\$148,034	\$144,470	7.6%	7.1%	5.3%
YoY	9.8%	-6.3%	1.4%	30.7%	19.3%	-2.4%			
Analog (\$mn)	\$58,785	\$53,939	\$55,658	\$74,105	\$88,983	\$81,146	6.7%	7.3%	5.6%
YoY (%)	10.8%	-8.2%	3.2%	33.1%	20.1%	-8.8%			
MCU (\$mn)	\$17,069	\$15,808	\$15,484	\$19,623	\$25,030	\$27,861	10.3%	6.6%	4.8%
YoY (%)	4.4%	-7.4%	-2.0%	26.7%	27.6%	11.3%			
Power Discretes (\$mn)	\$24,102	\$23,881	\$23,804	\$30,337	\$34,021	\$35,463	8.0%	6.9%	5.1%
YoY (%)	11.3%	-0.9%	-0.3%	27.4%	12.1%	4.2%			

Source: SIA, BofA Global Research Estimates

Pricing outgrew units across the semis landscape

Total semi sales grew at a +2% CAGR since CY18, driven by increasing ASPs related to Covid shortages (pricing +4% 5-yr CAGR) while units declined (-2% 5-yr CAGR) over the period on consumer weakness. Within diversified, analog was mixed while MCUs/Discretes saw ASPs +11%/9% 5-yr CAGRs while units fell -1% each, annualized.

Exhibit 3: Unit/ASP Analysis of semiconductor landscape for past 5, 10, 15 yr periods

Diversified semis ASPs have contributed the most to overall sales growth

	CY18	CY19	CY20	CY21	CY22	CY23	5-yr	10-yr	15-yr
Total Semiconductor sales (\$mn)	\$468,778	\$412,307	\$440,389	\$555,893	\$573,683	\$526,828	2.4%	5.6%	5.1%
YoY (%)	13.7%	-12.0%	6.8%	26.2%	3.2%	-8.2%			
Units (mn)	1,004,488	931,949	953,748	1,146,858	1,096,344	914,684	-1.9%	2.6%	3.3%
YoY (%)	7.4%	-7.2%	2.3%	20.2%	-4.4%	-16.6%			
ASPs (\$)	\$0.47	\$0.44	\$0.46	\$0.48	\$0.52	\$0.58	4.3%	2.9%	1.8%
YoY (%)	5.9%	-5.2%	4.4%	5.0%	8.0%	10.1%			
Memory Semis sales (\$mn)	\$157,967	\$106,440	\$117,482	\$153,838	\$129,801	\$92,309	-10.2%	3.2%	4.7%
YoY (%)	27.4%	-32.6%	10.4%	30.9%	-15.6%	-28.9%			
Units (mn)	41,724	42,428	44,652	50,143	43,590	43,685	0.9%	2.5%	3.4%
YoY (%)	-3.4%	1.7%	5.2%	12.3%	-13.1%	0.2%			
ASPs (\$)	\$3.79	\$2.51	\$2.63	\$3.07	\$2.98	\$2.11	-11.0%	0.7%	1.2%
YoY (%)	31.9%	-33.7%	4.9%	16.6%	-2.9%	-29.0%			
Core-Semis (Ex Memory) sales (\$mn)	\$310,812	\$305,867	\$322,907	\$402,054	\$443,882	\$434,518	6.9%	6.2%	5.2%
YoY (%)	7.8%	-1.6%	5.6%	24.5%	10.4%	-2.1%			
Units (mn)	962,764	889,521	909,095	1,096,715	1,052,754	870,998	-2.0%	2.6%	3.3%
YoY (%)	7.9%	-7.6%	2.2%	20.6%	-4.0%	-17.3%			
ASPs (\$)	\$0.32	\$0.34	\$0.36	\$0.37	\$0.42	\$0.50	9.1%	3.5%	1.9%
YoY (%)	-0.1%	6.5%	3.3%	3.2%	15.0%	18.3%			
Diversified Semis sales (\$mn)	\$99,956	\$93,628	\$94,946	\$124,065	\$148,034	\$144,470	7.6%	7.1%	5.3%
YoY (%)	9.8%	-6.3%	1.4%	30.7%	19.3%	-2.4%			
Units (mn)	634,477	585,382	611,661	750,322	734,873	639,971	0.2%	3.0%	3.0%
YoY (%)	3.3%	-7.7%	4.5%	22.7%	-2.1%	-12.9%			
ASPs (\$)	\$0.16	\$0.16	\$0.16	\$0.17	\$0.20	\$0.23	7.5%	4.0%	2.2%
YoY (%)	6.3%	1.5%	-2.9%	6.5%	21.8%	12.1%			
Analog sales (\$mn)	\$58,785	\$53,939	\$55,658	\$74,105	\$88,983	\$81,146	6.7%	7.3%	5.6%
YoY (%)	10.8%	-8.2%	3.2%	33.1%	20.1%	-8.8%			
Units (mn)	174,989	163,772	173,200	214,862	231,644	202,549	3.0%	6.9%	6.8%
YoY (%)	14.0%	-6.4%	5.8%	24.1%	7.8%	-12.6%			
ASPs (\$)	\$0.34	\$0.33	\$0.32	\$0.34	\$0.38	\$0.40	3.6%	0.4%	-1.1%
YoY (%)	-2.9%	-2.0%	-2.4%	7.3%	11.4%	4.3%			
MCU sales (\$mn)	\$17,069	\$15,808	\$15,484	\$19,623	\$25,030	\$27,861	10.3%	6.6%	4.8%
YoY (%)	4.4%	-7.4%	-2.0%	26.7%	27.6%	11.3%			
Units (mn)	27,568	25,036	26,226	29,742	28,228	26,814	-0.6%	5.6%	6.2%
YoY (%)	8.9%	-9.2%	4.8%	13.4%	-5.1%	-5.0%			
ASPs (\$)	\$0.62	\$0.63	\$0.59	\$0.66	\$0.89	\$1.04	10.9%	1.0%	-1.3%
YoY (%)	-4.2%	2.0%	-6.5%	11.7%	34.4%	17.2%			
Power Discretes sales (\$mn)	\$24,102	\$23,881	\$23,804	\$30,337	\$34,021	\$35,463	8.0%	6.9%	5.1%
YoY (%)	11.3%	-0.9%	-0.3%	27.4%	12.1%	4.2%			
Units (mn)	431,920	396,574	412,234	505,717	475,001	410,609	-1.0%	1.4%	1.6%
YoY (%)	-0.9%	-8.2%	3.9%	22.7%	-6.1%	-13.6%			
ASPs (\$)	\$0.06	\$0.06	\$0.06	\$0.06	\$0.07	\$0.09	9.1%	5.4%	3.4%
YoY (%)	12.3%	7.9%	-4.1%	3.9%	19.4%	20.6%			

Source: BofA Global Research, SiA

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Exhibit 4: Global semiconductor model (\$mn)

Auto and industrial semis grew +10%/7% annually over the past 5 years

	CY18	CY19	CY20	CY21	CY22	CY23	5-yr	10-yr
Total Semis (\$mn)	\$468,778	\$412,307	\$440,389	\$555,607	\$573,683	\$511,532	1.8%	5.3%
YoY (%)	13.7%	-12.0%	6.8%	26.2%	3.3%	-10.8%		
Memory	\$157,967	\$106,440	\$117,482	\$153,838	\$129,801	\$89,274	-10.8%	2.9%
YoY (%)	27.4%	-32.6%	10.4%	30.9%	-15.6%	-31.2%		
Core Semis (ex-memory)	\$310,812	\$305,867	\$322,907	\$401,769	\$443,882	\$422,258	6.3%	5.9%
YoY (%)	7.8%	-1.6%	5.6%	24.4%	10.5%	-4.9%		
Compute and Storage	\$100,603	\$96,744	\$107,550	\$128,040	\$129,151	\$119,648	3.5%	3.4%
YoY (%)	12.0%	-3.8%	11.2%	19.1%	0.9%	-7.4%		
Wireless Comms	\$72,183	\$76,604	\$85,082	\$104,025	\$111,088	\$103,065	7.4%	5.7%
YoY (%)	1.4%	6.1%	11.1%	22.3%	6.8%	-7.2%		
Auto	\$39,390	\$37,682	\$34,261	\$46,105	\$58,285	\$64,664	10.4%	9.7%
YoY (%)	9.9%	-4.3%	-9.1%	34.6%	26.4%	10.9%		
Global Auto Units (mn)	\$94	\$89	\$75	\$77	\$82	\$89	-1.1%	0.5%
YoY (%)	-1.0%	-5.6%	-16.1%	3.5%	6.2%	8.8%		
Auto semi content (\$/LV)	\$418	\$424	\$459	\$597	\$711	\$725	11.6%	9.1%
YoY (%)	11.0%	1.3%	8.4%	30.0%	19.0%	2.0%		
Industrial	\$45,894	\$43,916	\$42,755	\$54,097	\$65,358	\$63,436	6.7%	11.6%
YoY (%)	11.6%	-4.3%	-2.6%	26.5%	20.8%	-2.9%		
Consumer	\$34,149	\$32,914	\$35,068	\$48,218	\$52,293	\$44,589	5.5%	3.5%
YoY (%)	6.4%	-3.6%	6.5%	37.5%	8.5%	-14.7%		
Wired Comms	\$18,593	\$18,007	\$18,192	\$21,284	\$27,708	\$26,856	7.6%	6.0%
YoY (%)	2.1%	-3.1%	1.0%	17.0%	30.2%	-3.1%		

Source: BofA Global Research estimates, SIA

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Exhibit 5: Sales of key diversified vendors (\$mn)

In 2023 Infineon had the highest sales among diversified vendors at \$17bn

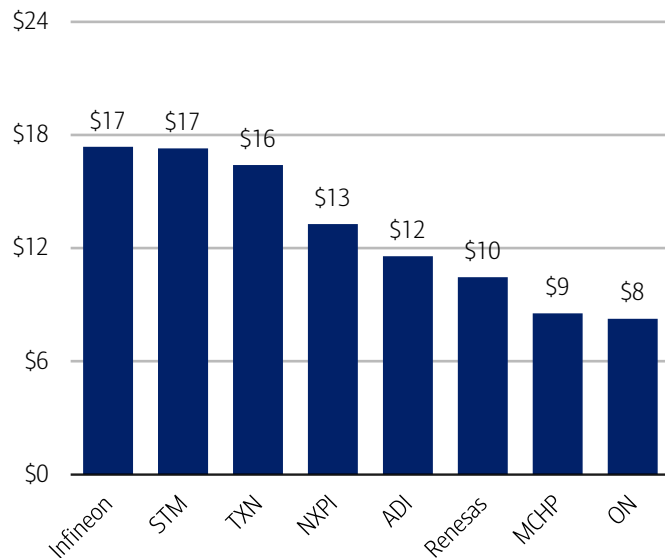
Diversified sales	CY18	CY19	CY20	CY21	CY22	CY23	CY24E	CY25E	'18-'23 CAGR	'23-'25E CAGR
Infineon sales (\$mn)	\$11,683	\$11,135	\$11,133	\$13,690	\$15,759	\$17,371	\$17,762	\$19,159	8.3%	5.0%
YoY (%)		-4.7%	0.0%	23.0%	15.1%	10.2%	2.3%	7.9%		
STMicro sales (\$mn)	\$9,664	\$9,556	\$10,219	\$12,761	\$16,128	\$17,286	\$16,324	\$18,204	12.3%	2.6%
YoY (%)		-1.1%	6.9%	24.9%	26.4%	7.2%	-5.6%	11.5%		
TXN sales (\$mn)	\$14,355	\$13,166	\$13,456	\$17,099	\$18,620	\$16,408	\$14,812	\$16,899	2.7%	1.5%
YoY (%)		-8.3%	2.2%	27.1%	8.9%	-11.9%	-9.7%	14.1%		
NXPI sales (\$mn)	\$9,407	\$8,877	\$8,612	\$11,063	\$13,205	\$13,276	\$13,133	\$14,194	7.1%	3.4%
YoY (%)		-5.6%	-3.0%	28.5%	19.4%	0.5%	-1.1%	8.1%		
Renesas sales (\$mn)	\$9,075	\$8,088	\$8,080	\$9,737	\$11,417	\$10,456	\$10,177	\$11,101	2.9%	3.0%
YoY (%)		-10.9%	-0.1%	20.5%	17.3%	-8.4%	-2.7%	9.1%		
ADI sales (\$mn)	\$8,696	\$7,945	\$8,236	\$10,606	\$12,579	\$11,569	\$9,093	\$10,813	5.9%	-3.3%
YoY (%)		-7.2%	3.7%	28.8%	18.6%	-8.0%	-21.4%	18.9%		
ON sales (\$mn)	\$5,878	\$5,518	\$5,255	\$6,740	\$8,326	\$8,253	\$7,534	\$8,287	7.0%	0.2%
YoY (%)		-6.1%	-4.8%	28.3%	23.5%	-0.9%	-8.7%	10.0%		
MCHP sales (\$mn)	\$5,022	\$5,278	\$5,298	\$6,444	\$8,050	\$8,541	\$5,666	\$6,943	11.2%	-9.8%
YoY (%)		5.1%	0.4%	21.6%	24.9%	6.1%	-33.7%	22.5%		
Total (\$mn)	\$73,780	\$69,562	\$70,289	\$88,139	\$104,085	\$103,159	\$94,501	\$105,601	6.9%	1.2%
YoY (%)		-5.7%	1.0%	25.4%	18.1%	-0.9%	-8.4%	11.7%		

Source: BofA Global Research, Bloomberg, company reports

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Exhibit 6: CY23 sales of diversified vendors (\$bn)

European vendors Infineon and STM tied for top sales in 2023

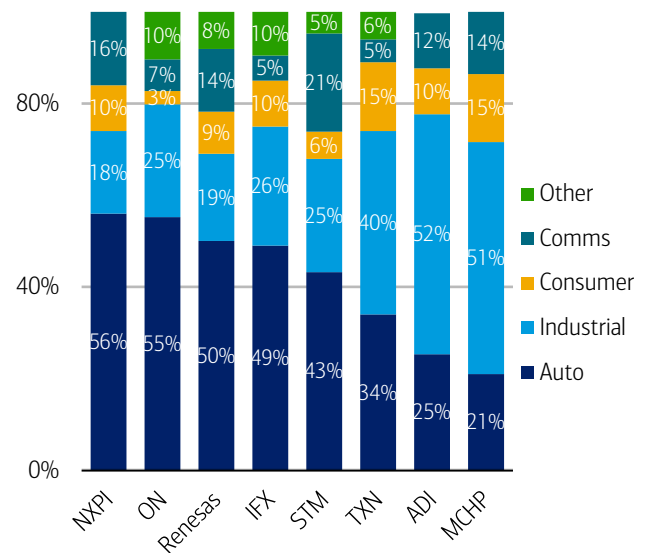


Source: BofA Global Research, Bloomberg, company reports

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Exhibit 7: Diversified vendor sales end mkt share (%)

Diversified vendors derive 50%+ of sales from auto/industrial



Source: BofA Global Research, Bloomberg, company reports

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Exhibit 8: Auto vendor sales (\$mn)

Infineon leads the auto semis market, at \$9bn+ sales in CY23

Auto sales	CY18	CY19	CY20	CY21	CY22	CY23	CY24E	CY25E	18-'23E CAGR	23-'25E CAGR
Infineon sales (\$mn)	\$4,782	\$4,726	\$4,419	\$6,004	\$7,343	\$9,145	\$10,060	\$12,273	13.8%	15.8%
YoY (%)		-1.2%	-6.5%	35.8%	22.3%	24.5%	10.0%	22.0%		
NXPI sales (\$mn)	\$4,507	\$4,212	\$3,825	\$5,493	\$6,879	\$7,484	\$7,470	\$8,272	10.7%	5.1%
YoY (%)		-6.5%	-9.2%	43.6%	25.2%	8.8%	-0.2%	10.7%		
STMicro sales (\$mn)	\$2,780	\$2,830	\$2,613	\$3,515	\$5,250	\$5,321	\$5,587	\$6,705	13.9%	12.2%
YoY (%)		1.8%	-7.7%	34.5%	49.4%	1.4%	5.0%	20.0%		
TXN Sales (\$mn)	\$3,157	\$3,020	\$2,892	\$3,852	\$5,007	\$5,956	\$5,309	\$6,089	13.5%	1.1%
YoY (%)		-4.3%	-4.2%	33.2%	30.0%	19.0%	-10.9%	14.7%		
Renesas sales (\$mn)	\$3,608	\$3,404	\$3,194	\$4,208	\$4,907	\$4,946	\$4,855	\$5,311	6.5%	3.6%
YoY (%)		-5.7%	-6.2%	31.7%	16.6%	0.8%	-1.8%	9.4%		
ON sales (\$mn)	\$1,843	\$1,816	\$1,686	\$2,289	\$3,361	\$4,320	\$4,252	\$4,856	18.6%	6.0%
YoY (%)		-1.4%	-7.2%	35.7%	46.8%	28.5%	-1.6%	14.2%		
ADI sales (\$mn)	\$1,533	\$1,458	\$1,445	\$1,979	\$2,594	\$2,927	\$2,776	\$3,217	13.8%	4.9%
YoY (%)		-4.9%	-0.9%	37.0%	31.1%	12.8%	-5.1%	15.9%		
MCHP sales (\$mn)	\$804	\$844	\$874	\$1,095	\$1,369	\$1,452	\$963	\$1,180	12.6%	-9.8%
YoY (%)		5.1%	3.5%	25.3%	24.9%	6.1%	-33.7%	22.5%		
Total (\$mn)	\$23,013	\$22,312	\$20,949	\$28,435	\$36,710	\$41,552	\$41,272	\$47,904	12.5%	7.4%
YoY (%)		-3.0%	-6.1%	35.7%	29.1%	13.2%	-0.7%	16.1%		

Source: BofA Global Research estimates, Bloomberg, company reports

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Exhibit 9: Auto vendor share (%)

Infineon held leading auto semis share in CY23

Auto vendor share	CY18	CY19	CY20	CY21	CY22	CY23	CY24E	CY25E
Infineon share (%)	12.1%	12.5%	12.9%	13.0%	12.6%	14.1%	14.9%	16.8%
YoY (bps)		40	36	12	-42	154	79	189
NXPI share (%)	11.4%	11.2%	11.2%	11.9%	11.8%	11.6%	11.1%	11.3%
YoY (bps)		-26	-1	75	-11	-23	-48	25
STMicro share (%)	7.1%	7.5%	7.6%	7.6%	9.0%	8.2%	8.3%	9.2%
YoY (bps)		45	12	0	138	-78	7	90
TXN share (%)	8.0%	8.0%	8.4%	8.4%	8.6%	9.2%	7.9%	8.3%
YoY (bps)		0	43	-9	24	62	-133	47
Renesas share (%)	9.2%	9.0%	9.3%	9.1%	8.4%	7.6%	7.2%	7.3%
YoY (bps)		-13	29	-20	-71	-77	-44	7
ON share (%)	4.7%	4.8%	4.9%	5.0%	5.8%	6.7%	6.3%	6.7%
YoY (bps)		14	10	4	80	91	-37	34
ADI share (%)	3.9%	3.9%	4.2%	4.3%	4.5%	4.5%	4.1%	4.4%
YoY (bps)		-2	35	8	16	8	-40	29
MCHP share (%)	2.0%	2.2%	2.6%	2.4%	2.3%	2.2%	1.4%	1.6%
YoY (bps)		20	31	-18	-3	-10	-82	19

Source: BofA Global Research estimates, Bloomberg, company reports

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Exhibit 10: Industrial vendor sales (\$mn)

TXN industrial sales were highest of peers in CY23

Industrial sales	CY18	CY19	CY20	CY21	CY22	CY23	CY24E	CY25E	18-'23 CAGR	23-'25E CAGR
TXN Sales (\$mn)	\$5,682	\$5,178	\$5,351	\$7,521	\$8,011	\$7,008	\$6,009	\$7,217	4.3%	1.5%
YoY (%)		-8.9%	3.3%	40.6%	6.5%	-12.5%	-14.2%	20.1%		
ADI sales (\$mn)	\$3,773	\$3,595	\$3,927	\$4,975	\$6,549	\$6,039	\$4,175	\$5,038	9.9%	-8.7%
YoY (%)		-4.7%	9.2%	26.7%	31.7%	-7.8%	-30.9%	20.7%		
STMicro sales (\$mn)	\$2,286	\$1,914	\$1,974	\$2,774	\$3,751	\$3,901	\$2,926	\$3,218	11.3%	-9.2%
YoY (%)		-16.3%	3.1%	40.5%	35.2%	4.0%	-25.0%	10.0%		
NXPI sales (\$mn)	\$1,813	\$1,599	\$1,836	\$2,410	\$2,713	\$2,351	\$2,466	\$2,687	5.3%	6.9%
YoY (%)		-11.8%	14.8%	31.3%	12.6%	-13.3%	4.9%	9.0%		
MCHP sales (\$mn)	\$1,908	\$2,058	\$2,119	\$2,578	\$3,301	\$3,502	\$2,323	\$2,847	12.9%	-9.8%
YoY (%)		7.9%	3.0%	21.6%	28.1%	6.1%	-33.7%	22.5%		
Infineon sales (\$mn)	\$2,106	\$1,917	\$1,638	\$1,848	\$2,003	\$2,371	\$2,259	\$2,506	2.4%	2.8%
YoY (%)		-9.0%	-14.6%	12.8%	8.4%	18.4%	-4.7%	10.9%		
ON sales (\$mn)	\$1,579	\$1,425	\$1,355	\$1,802	\$2,291	\$2,278	\$1,858	\$2,080	7.6%	-4.5%
YoY (%)		-9.7%	-4.9%	33.0%	27.1%	-0.5%	-18.4%	11.9%		
Renesas sales (\$mn)	\$1,238	\$1,194	\$1,278	\$1,456	\$1,931	\$1,878	\$1,586	\$1,692	8.7%	-5.1%
YoY (%)		-3.6%	7.0%	13.9%	32.6%	-2.7%	-15.5%	6.7%		
Total (\$mn)	\$20,385	\$18,880	\$19,477	\$25,363	\$30,549	\$29,328	\$23,603	\$27,286	7.5%	-3.5%
YoY (%)		-7.4%	3.2%	30.2%	20.4%	-4.0%	-19.5%	15.6%		

Source: BofA Global Research estimates, Bloomberg, company reports

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Exhibit 11: Industrial vendor share (%)

TXN held leading industrial semis share in CY23

Industrial vendor share	CY18	CY19	CY20	CY21	CY22	CY23	CY24E	CY25E
TXN Sales (\$mn)	12.4%	11.8%	12.5%	13.9%	12.3%	11.0%	11.6%	12.6%
YoY (%)		-59	72	139	-165	-121	58	99
ADI sales (\$mn)	8.2%	8.2%	9.2%	9.2%	10.0%	9.5%	8.1%	8.8%
YoY (%)		-4	100	1	82	-50	-144	73
STMicro sales (\$mn)	5.0%	4.4%	4.6%	5.1%	5.7%	6.1%	5.7%	5.6%
YoY (%)		-62	26	51	61	41	-49	-4
MCHP sales (\$mn)	4.2%	4.7%	5.0%	4.8%	5.1%	5.5%	4.5%	5.0%
YoY (%)		53	27	-19	29	47	-103	48
NXPI sales (\$mn)	4.0%	3.6%	4.3%	4.5%	4.2%	3.7%	4.8%	4.7%
YoY (%)		-31	65	16	-30	-44	106	-7
Infineon sales (\$mn)	4.6%	4.4%	3.8%	3.4%	3.1%	3.7%	4.4%	4.4%
YoY (%)		-23	-53	-41	-35	67	63	1
ON sales (\$mn)	3.4%	3.2%	3.2%	3.3%	3.5%	3.6%	3.6%	3.6%
YoY (%)		-19	-8	16	17	9	0	4
Renesas sales (\$mn)	2.7%	2.7%	3.0%	2.7%	3.0%	3.0%	3.1%	3.0%
YoY (%)		2	27	-30	26	1	11	-11

Source: BofA Global Research estimates, Bloomberg, company reports

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Overview of the Analog Market

The \$80bn analog market can be split across 1) **General Purpose Analog (\$29bn)** - Standard products servicing all markets, consisting of chips used to implement functions such as power mgmt, voltage regulation, data conversion, interface drivers, and signal amplification, and 2) **Application specific Analog (\$52bn)**: customized analog chips geared toward specific end-market application such as handsets, PCs, consumer, autos, and more. From 2013-20, both gen purpose and application specific analog grew at a mid-single digit CAGR, though growth accelerated in CY21/22 on content/ASP tailwinds.

Exhibit 12: Overview of Analog TAM by submarket (over-time)

App Specific Analog has slightly outpaced general purpose analog over time

Analog Market Breakdown (\$bn)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	5-yr CAGR	10-yr CAGR
Total Analog Sales	\$40.1	\$44.4	\$45.2	\$47.8	\$53.1	\$58.8	\$53.9	\$55.7	\$74.1	\$89.0	\$81.1	6.7%	7.3%
General Purpose	\$16.0	\$18.2	\$18.6	\$19.5	\$21.8	\$23.6	\$22.5	\$23.2	\$30.1	\$35.6	\$29.4	4.5%	6.3%
Amplifiers/Comparators	\$2.6	\$2.9	\$2.8	\$2.9	\$3.2	\$3.5	\$3.3	\$3.3	\$4.3	\$4.7	\$4.2	3.8%	5.0%
Interface	\$1.9	\$2.0	\$2.0	\$2.1	\$2.1	\$2.2	\$1.9	\$2.1	\$2.8	\$3.4	\$2.9	5.6%	4.3%
Pwr Mgmt	\$9.2	\$10.8	\$11.0	\$11.2	\$12.7	\$14.3	\$13.8	\$14.4	\$19.0	\$22.7	\$17.9	4.6%	6.9%
Signal Conversion	\$2.3	\$2.5	\$2.9	\$3.3	\$3.8	\$3.6	\$3.4	\$3.4	\$3.9	\$4.8	\$4.4	4.1%	6.7%
App Specific	\$24.1	\$26.2	\$26.6	\$28.3	\$31.3	\$35.2	\$31.5	\$32.5	\$44.0	\$53.4	\$51.7	8.0%	7.9%
Consumer	\$1.8	\$1.9	\$1.8	\$2.2	\$2.3	\$2.4	\$2.0	\$2.1	\$2.9	\$3.2	\$2.1	(2.3%)	1.7%
Compute	\$2.3	\$2.4	\$2.1	\$1.9	\$2.2	\$2.5	\$2.0	\$2.1	\$2.8	\$3.5	\$2.9	3.2%	2.4%
Wireless Comms	\$9.7	\$11.3	\$12.2	\$12.5	\$13.9	\$16.0	\$13.9	\$14.9	\$20.9	\$24.6	\$21.3	5.8%	8.2%
Wired Comms	\$2.1	\$1.5	\$1.7	\$1.5	\$1.6	\$1.6	\$1.4	\$1.6	\$2.1	\$2.4	\$2.0	5.1%	(0.3%)
Auto	\$5.9	\$6.6	\$6.6	\$7.7	\$8.6	\$9.6	\$9.5	\$8.9	\$11.7	\$15.0	\$18.7	14.3%	12.3%
Industrial	\$2.3	\$2.5	\$2.1	\$2.5	\$2.6	\$3.1	\$2.8	\$2.8	\$3.7	\$4.6	\$4.6	8.2%	7.2%

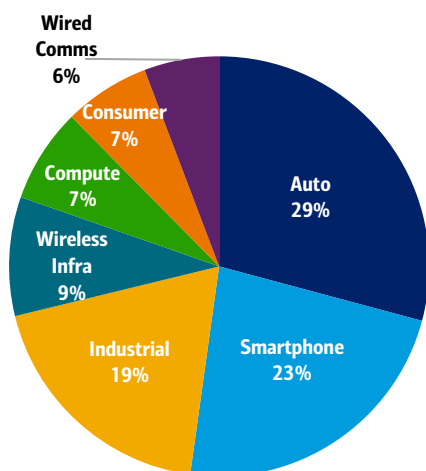
Source: BofA Global Research, SIA/WSTS, Omdia, Company reports

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Looking at sales by end market, top markets include: 1) Autos (29%), 2) Smartphone (23%), and 3) Industrial (19%). However, when differentiating by general purpose and app specific components, there are nuances. Industrial makes up a much larger component of general-purpose sales (37%). Conversely, auto/smartphone sales tilt more towards application specific analog components. We note smartphone is inclusive of devices such as modems, radio frequency, etc.

Exhibit 13: Overall Analog Sales by Mkt

Smartphone, Auto, Industrial largest markets

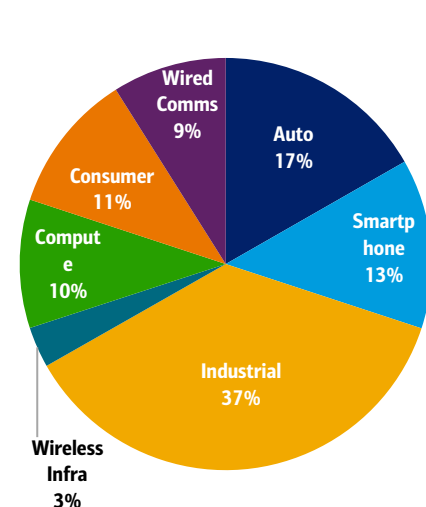


Source: Omdia, SIA/WSTS

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Exhibit 14: Gen Purp. Analog Sales by Market

Industrial key end market in gen purpose market

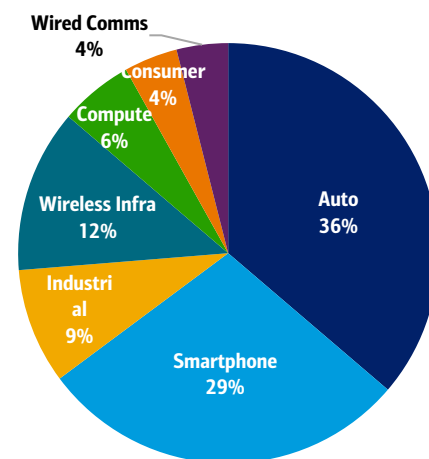


Source: Omdia, SIA/WSTS

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Exhibit 15: App Specific Sales by Market

Smartphone, auto large app specific markets



Source: Omdia, SIA/WSTS

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Drivers of general purpose analog market

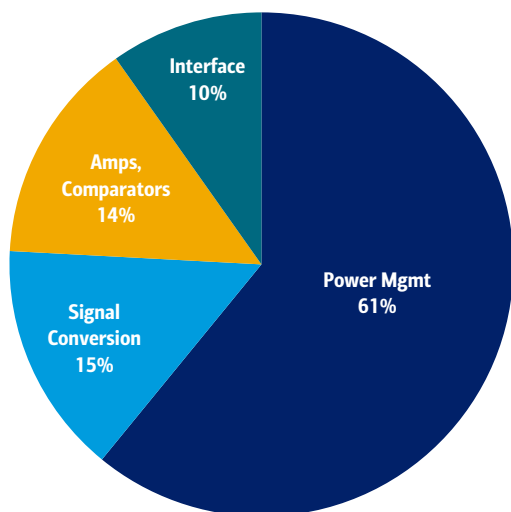
The primary drivers of the General Purpose market include 1) **Power Management ICs** (help convert, control or distribute digital converter power), 2) **Signal Conversion** (converts signal from Analog-to-Digital or Digital-to-Analog), 3)

Amplifiers/Comparators (condition or modify an incoming analog signal to enhance it for further processing), and 4) **Interface** (modify or shape the signal in order to ensure signal integrity for transmission over a distance through a physical medium).

By market share, Analog Devices and Texas Instruments in aggregate control approximately 50% of the market, with a relatively even distribution between the two companies. Notably, the next largest competitors account for only ~15% of the market, highlighting ADI and TXN unrivaled leadership position.

Exhibit 16: General Purpose TAM by device type

Majority of general purpose TAM relates to Power mgmt

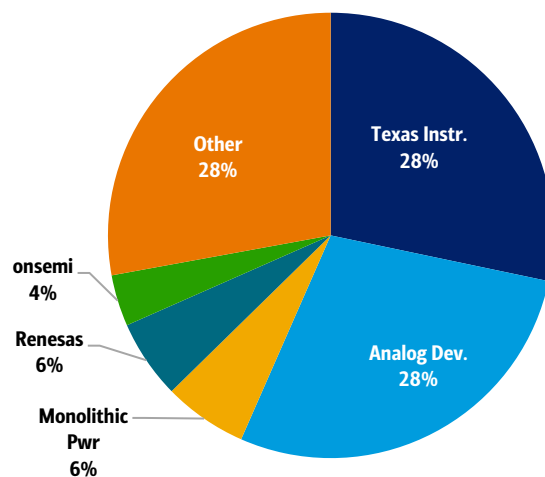


Source: BofA Global Research, SIA/WSTS

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Exhibit 17: General Purpose Analog market share

Both ADI and Texas Instruments are market leaders in gen purpose analog



Source: BofA Global Research, SIA/WSTS

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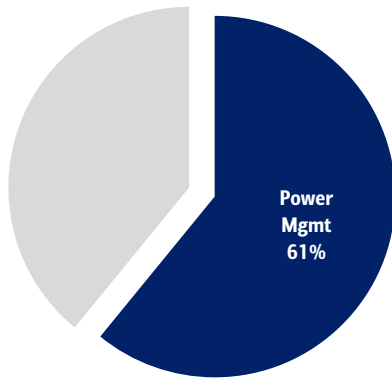
Power Management

Power management components are the main contributor to General Purpose analog sales, accounting for >60% of the subsegment. Power management ICs (PMICs) help convert a source voltage into another voltage to help power other ICs. Products include linear/switching regulators (use a non-switching/switching circuit for voltage conversion), voltage references (provide constant voltage source to a given load), battery charging and management, and several more for other various applications.

Per SIA, power management sales nearly reached \$23bn in CY22, though fell to \$18bn in CY23. From CY17-22, power management analog IC sales grew at a 12% CAGR versus the broader market around high single digits. Despite near-term headwinds, power management should remain a strong category within Analog, as more power intensive applications emerge in areas such as industrial and automotive.

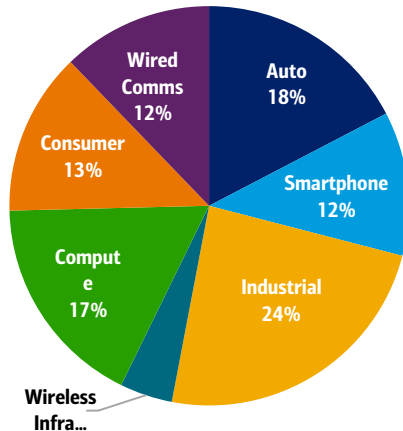
Within power management, Analog Devices and Texas Instruments are the primary market leaders. Notably, Texas Instruments (21% market share) and ADI (19% market share) hold roughly equal share, and account for ~40% of the market. Outside the top two vendors, the next 3 largest vendors hold just ~20% market share. The diversified portfolios of both ADI and TXN put each in position to maintain market leadership through a potential upcoming growth cycle.

Exhibit 18: Power mgmt in gen purpose mkt
Power mgmt >60% of gen purpose mkt



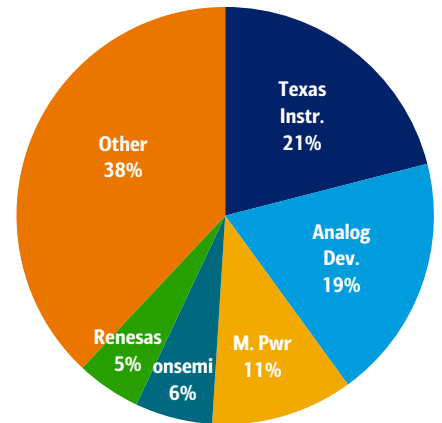
Source: BofA Global Research, SIA/WSTS
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Exhibit 19: Power mgmt sales by end mkt
Industrial largest mkt in power mgmt



Source: BofA Global Research, SIA/WSTS, Omdia
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Exhibit 20: Power mgmt share (as of CY22)
ADI, TXN primary market vendors in power mgmt



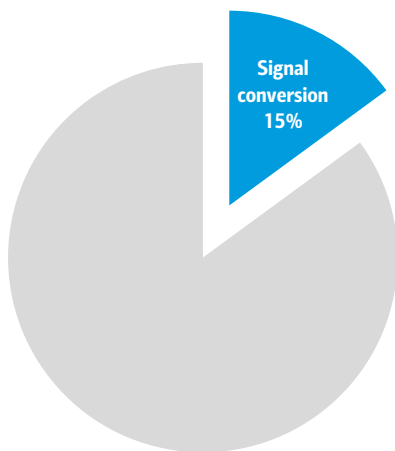
Source: BofA Global Research, SIA/WSTS, Omdia
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Signal Conversion

Signal Conversion focuses on analog ICs that primarily convert a signal from one form to another for additional processing by other ICs (including digital ICs). Related applications include Analog to Digital conversion (ADC), Digital to Analog conversion (DAC), Voltage to Frequency conversion. The complexity of the data converter is dependent on the degree or quality of resolution with both high-speed (typically results in lower data resolution capabilities) and high-resolution (typically this results in lower speeds) commanding higher margins.

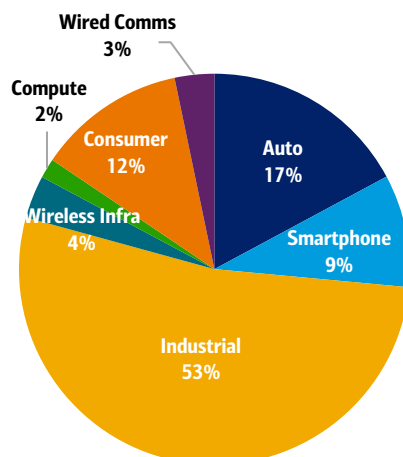
Analog Devices holds more than 50% market share, highlighting leadership and expertise. Texas Instruments accounts for nearly 30% of the market, two vendors make up nearly 85% of the TAM, creating a near market duopoly

Exhibit 21: Signal conversion % of TAM
Signal conversion ~15% of gen purpose mkt



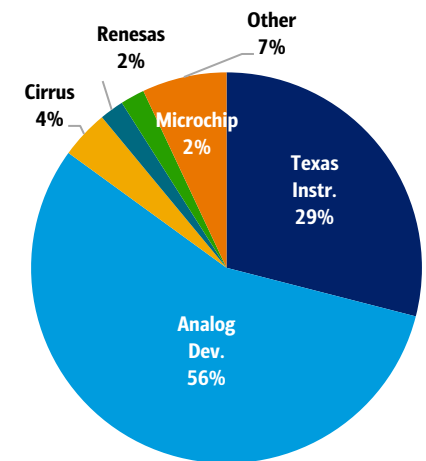
Source: BofA Global Research, SIA/WSTS
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Exhibit 22: Signal conversion sales by mkt
Industrial most critical driver of signal conversion



Source: BofA Global Research, SIA/WSTS
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Exhibit 23: Signal conversion share (CY22)
ADI holds >50% in signal conversion market



Source: BofA Global Research, SIA/WSTS
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Amplifiers and Comparators

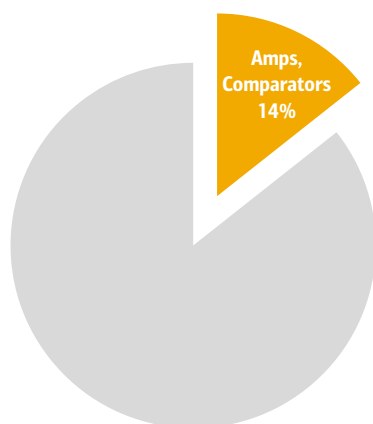
Amplifiers and Comparators assist in conditioning or modifying an analog signal to improve it for further processing (such as in signal conversion or interface functions)..

Per SIA, amplifiers and comparators contribute roughly \$4bn in Analog sales. Products primarily ship into industrial applications (43% of sales) as well as mobile devices (25% of sales) requiring components to support data processing and transmission in a handset.

Amplifiers and comparators are a much smaller category in general purpose analog compared to power management ICs, though are still an area primarily controlled by both Analog Devices and Texas Instruments, holding approximately ~70% market share in aggregate. The remaining 30% of the market is well divided, with the following top 3 vendors less than 15% of the total market.

Exhibit 24: Amps + gen purpose market

Amps, comparators ~15% of gen purpose market

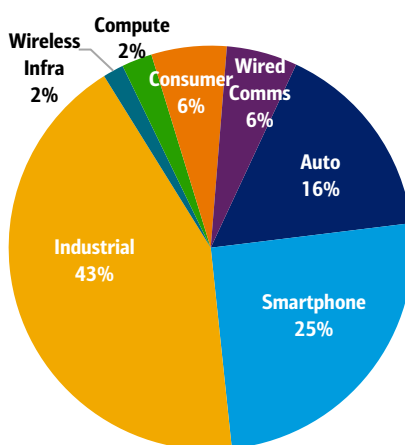


Source: BofA Global Research, SIA/WSTS

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Exhibit 25: Amps, comparators sales by mkt

Industrial, smartphones drive >70% of market

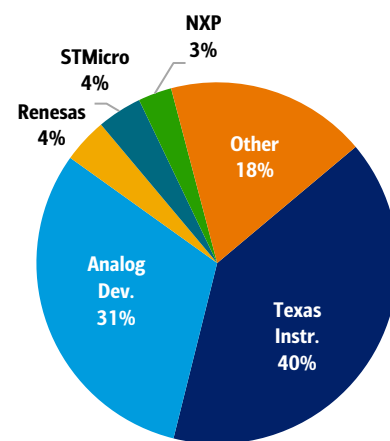


Source: BofA Global Research, SIA/WSTS, Omdia

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Exhibit 26: Amps, comparators share (CY22)

TXN, ADI hold 70%+ market share in aggregate



Source: BofA Global Research, SIA/WSTS, Omdia

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Interface

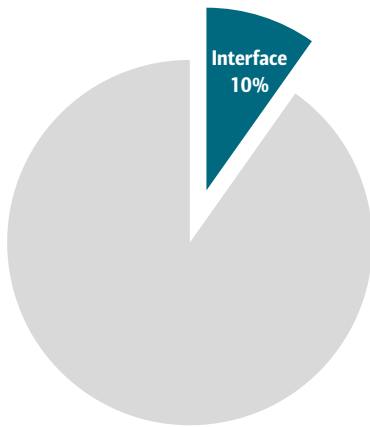
The last remaining major general purpose analog category relates to interface components. Interface chips drive transmission lines (such as USB, SATA), displays (LEDs, LCDs, lasers) and radio frequencies (Wi-Fi, Bluetooth) and are also used for distributing power to the system devices. Interface products are critical in helping maintain signal integrity.

Interface analog components are a small portion of the overall General Purpose TAM (~10% of sales), though industrial accounts for >50% of total market sales, positive for industrial analog exposed peers.

Within this market, Texas Instruments holds market leadership (30% of sales), but Analog Devices market share (~20% market share) still has carved out solid market positioning. Similar to other general-purpose markets, vendors outside Analog Devices and Texas Instruments hold more muted positions, with the next top 3 interface analog suppliers accounting for less than 20% of the total market.

Exhibit 27: Interface TAM % of gen purp

Interface accounts for ~10% of gen pup. mkt

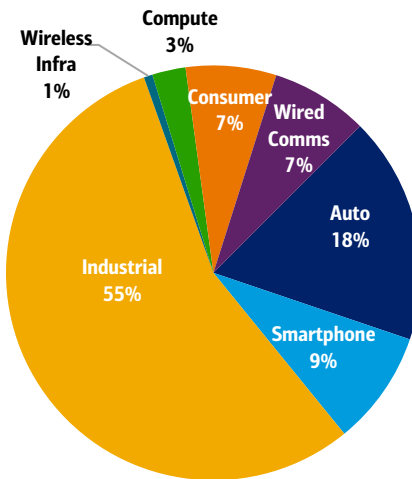


Source: BofA Global Research, SIA/WSTS

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Exhibit 28: Interface sales by end market

Industrial accounts for >50% of the market

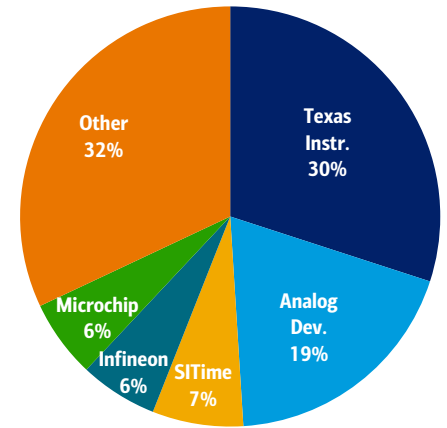


Source: BofA Global Research, SIA/WSTS

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Exhibit 29: Interface market share (CY22)

Texas Instruments market leader in interface



Source: BofA Global Research, SIA/WSTS

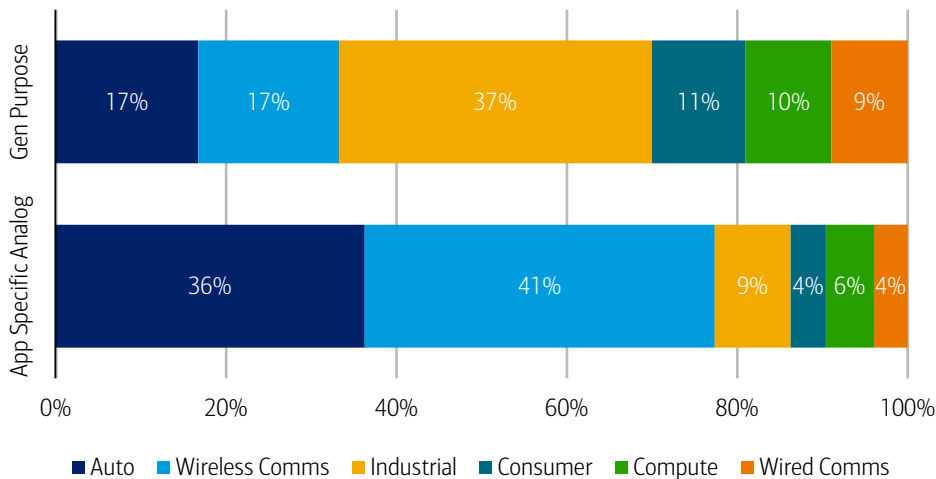
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Breakdown of the applications-specific analog market

Application specific analog products are circuits uniquely designed for a specific end market (wireless infrastructure, automotive, industrial, etc.). Application specific analog components primarily come from auto/wireless comms markets, which represents >75% of total sales. This is well above general purpose (35% of sales from auto/wireless). Application specific analog also is less exposed to industrial versus general purpose.

Exhibit 30: Analog sales by general product type and end market

App specific much more weighted to automotive than gen purpose



Source: BofA Global Research, SIA/WSTS, Omdia

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Overview of the Microcontroller (MCU) Market

The \$28bn (CY23) MCU market can be split into 8-bit, 16-bit, and 32-bits, and refers to standalone integrated circuits that perform embedded computing functions without the support of other ICs. MCUs are best suited to applications which require minimal power drain and processing power, and are dedicated to one task on one specific program, rather than the more general purpose CPUs.

Exhibit 31: MCU 8-bit, 16-bit, 32-bit sales/units/ASPs analysis

32-bit MCUs saw the strongest sales growth, mostly driving by ASP growth 2018-2023

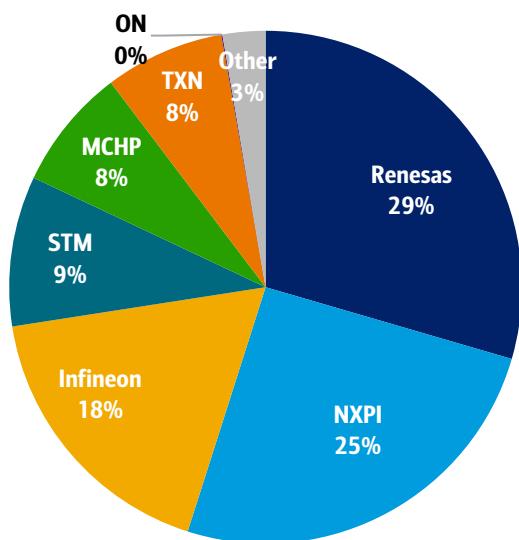
MCU Break-out	CY18	CY19	CY20	CY21	CY22	CY23	'18-'23 CAGR
8-bit sales (\$mn)	\$3,110	\$2,466	\$2,229	\$2,302	\$2,536	\$3,477	2.3%
YoY (%)		-20.7%	-9.6%	3.3%	10.2%	37.1%	
8-bit units (mn)	7,088	5,058	4,782	5,116	4,088	5,294	-5.7%
YoY (%)		-28.6%	-5.5%	7.0%	-20.1%	29.5%	
8-bit ASP (\$)	\$0.44	\$0.49	\$0.47	\$0.45	\$0.62	\$0.66	8.3%
YoY (%)		10.8%	-4.4%	-3.5%	37.9%	5.9%	
16-bit sales (\$mn)	\$4,068	\$3,799	\$3,483	\$4,404	\$4,947	\$4,099	0.2%
YoY (%)		-6.6%	-8.3%	26.4%	12.3%	-17.1%	
16-bit units (mn)	5,951	6,162	6,631	8,866	7,749	5,704	-0.8%
YoY (%)		3.6%	7.6%	33.7%	-12.6%	-26.4%	
16-bit ASP (\$)	\$0.68	\$0.62	\$0.53	\$0.50	\$0.64	\$0.72	1.1%
YoY (%)		-9.4%	-14.8%	-5.4%	28.5%	12.6%	
32-bit sales (\$mn)	\$9,815	\$9,471	\$9,710	\$12,829	\$17,433	\$20,241	15.6%
YoY (%)		-3.5%	2.5%	32.1%	35.9%	16.1%	
32-bit units (mn)	14,103	13,759	14,715	15,557	16,281	15,780	2.3%
YoY (%)		-2.4%	6.9%	5.7%	4.7%	-3.1%	
32-bit ASP (\$)	\$0.70	\$0.69	\$0.66	\$0.82	\$1.07	\$1.28	12.9%
YoY (%)		-1.7%	-4.1%	25.0%	29.8%	19.8%	

Source: Bloomberg Global Research, SIA

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Exhibit 32: Auto MCU CY23 mkt share (%)

Renesas dominates the auto MCU market

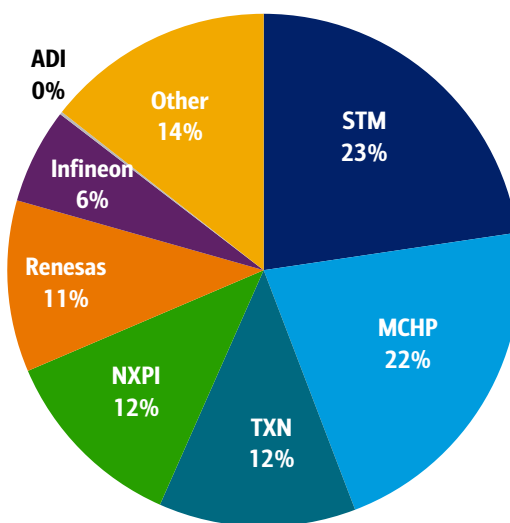


Source: Bloomberg Global Research, SIA

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Exhibit 33: Industrial MCU CY23 mkt share (%)

STM holds leading industrial MCU market share



Source: Bloomberg Global Research, SIA

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Diversified Profitability

Exhibit 34: Diversified semis EPS (\$/sh)

NXPI has leading EPS at \$14+/sh in CY23

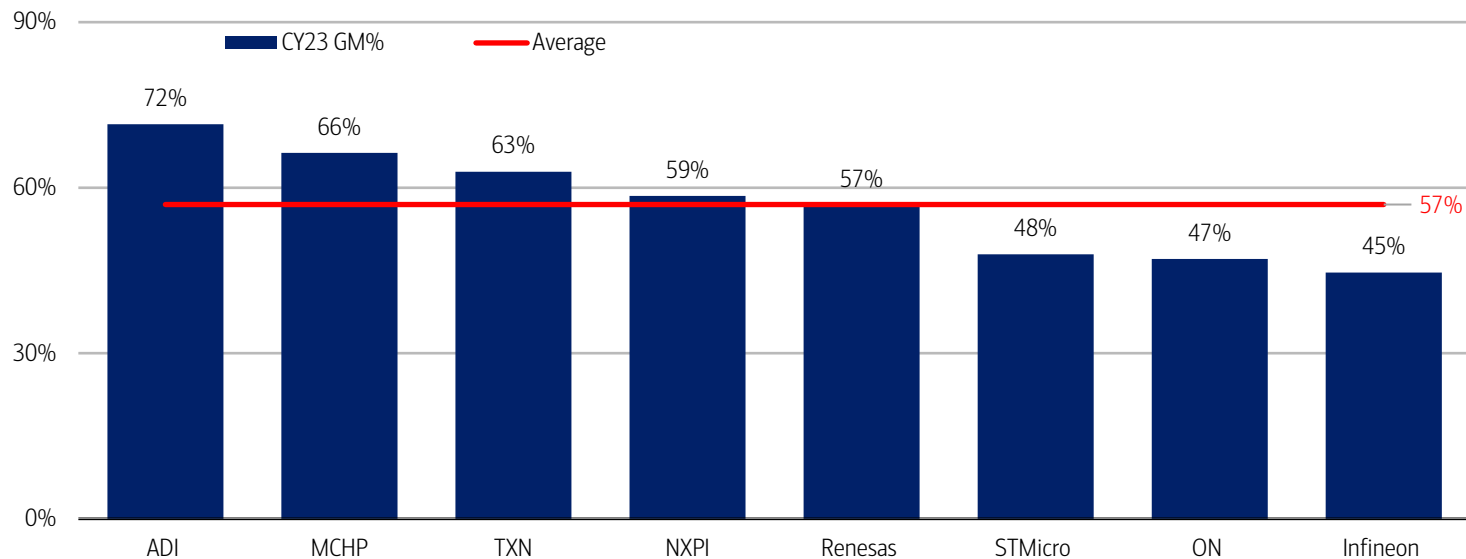
EPS (\$)	CY18	CY19	CY20	CY21	CY22	CY23	CY24E	CY25E	18-'23 CAGR	23-'25E CAGR
NXPI	\$7.28	\$7.57	\$6.13	\$10.70	\$14.40	\$14.03	\$13.54	\$15.34	14.0%	4.6%
YoY (%)		3.9%	-18.9%	74.5%	34.5%	-2.6%	-3.5%	13.3%		
ADI	\$7.95	\$6.44	\$7.23	\$8.06	\$10.38	\$9.07	\$6.00	\$8.28	2.7%	-4.5%
YoY (%)		-19.1%	12.4%	11.4%	28.8%	-12.6%	-33.9%	38.0%		
TXN	\$5.59	\$5.24	\$5.97	\$8.26	\$9.41	\$7.07	\$5.11	\$6.62	4.8%	-3.2%
YoY (%)		-6.3%	13.9%	38.5%	13.8%	-24.8%	-27.7%	29.5%		
ON	\$1.96	\$1.49	\$0.85	\$2.95	\$5.33	\$5.16	\$4.30	\$5.18	21.4%	0.2%
YoY (%)		-24.0%	-42.7%	246.7%	80.4%	-3.2%	-16.6%	20.4%		
MCHP	\$3.23	\$2.82	\$3.10	\$4.19	\$5.73	\$5.99	\$2.66	\$4.12	13.1%	-17.1%
YoY (%)		-12.9%	10.1%	35.1%	36.9%	4.5%	-55.6%	54.9%		
STM	\$1.43	\$1.15	\$1.21	\$2.16	\$4.19	\$4.46	\$3.16	\$4.05	25.5%	-4.7%
YoY (%)		-19.6%	5.2%	78.5%	94.0%	6.4%	-29.1%	28.2%		
Infineon	\$1.63	\$1.13	\$0.84	\$1.57	\$2.29	\$2.76	\$2.31	\$2.85	11.1%	1.6%
YoY (%)		-30.7%	-25.8%	86.9%	45.9%	20.5%	-16.3%	23.4%		
Renesas	\$0.58	\$0.12	\$0.39	\$0.69	\$1.05	\$1.35	\$1.41	\$1.60	18.2%	8.9%
YoY (%)		-78.8%	213.0%	77.4%	52.4%	28.6%	4.4%	13.5%		

Source: BofA Global Research, Bloomberg, company reports

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Exhibit 35: Diversified semis Gross Margin (CY23)

Average gross margin for the group is high at 57%

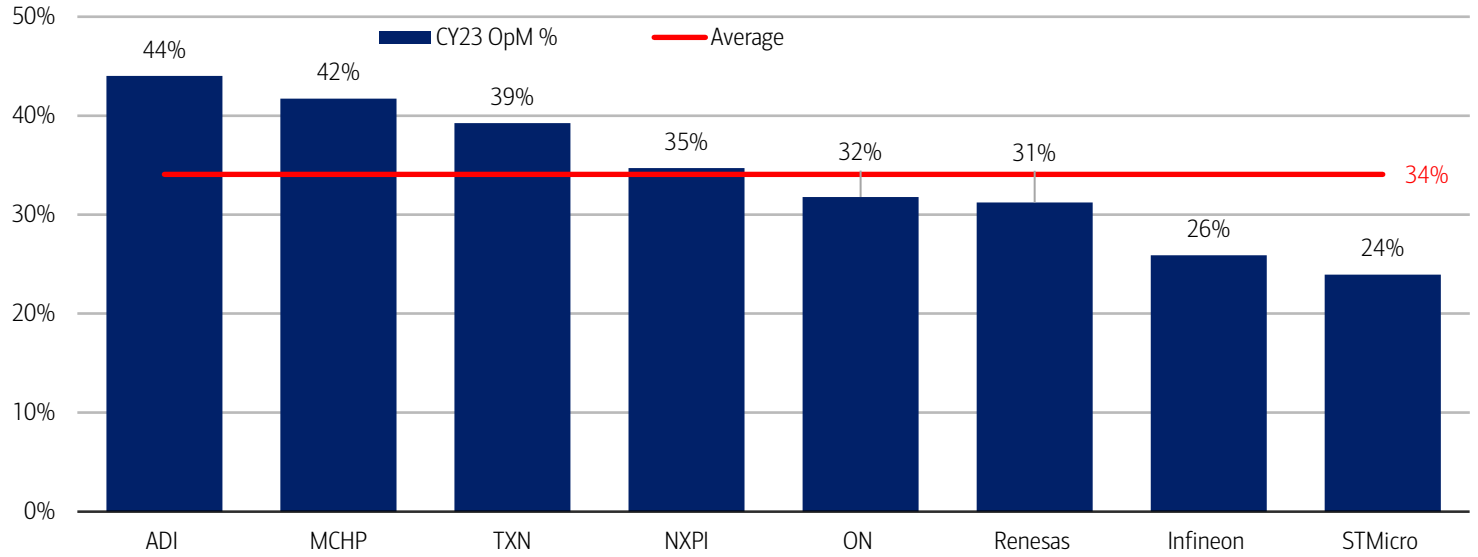


Source: BofA Global Research, Bloomberg

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Exhibit 36: Diversified Operating margin (CY23)

Average OpM for the group is 34%

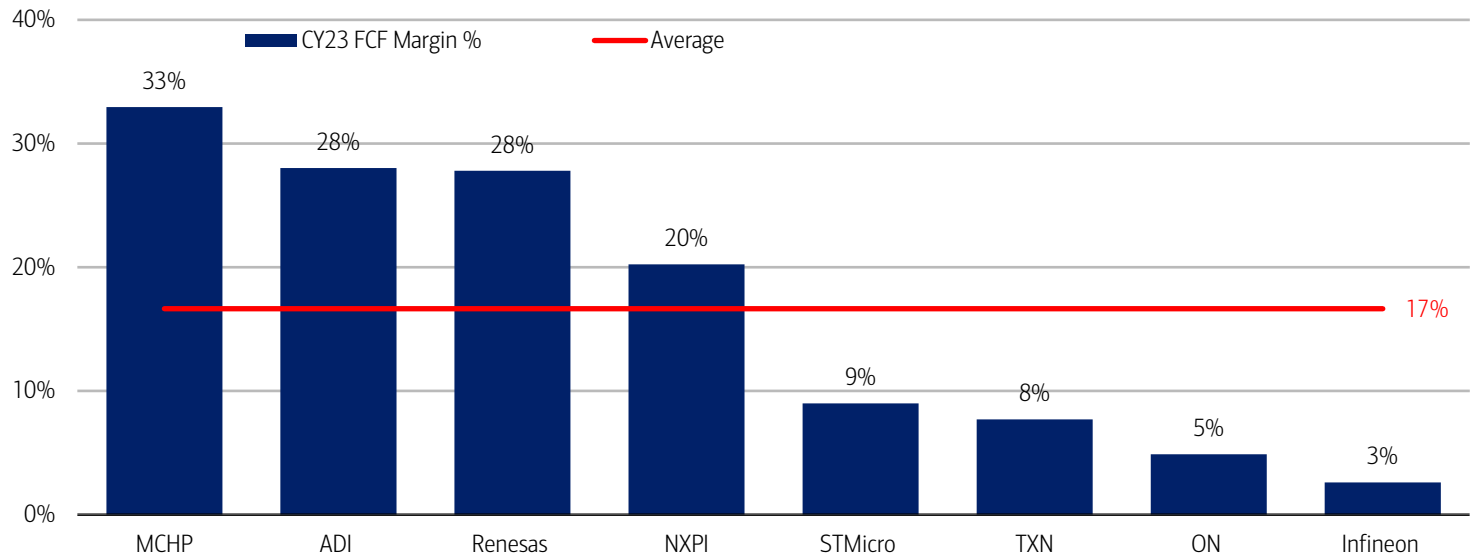


Source: BofA Global Research, Bloomberg

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Exhibit 37: Diversified FCF margins (CY23)

MCHP had the strongest FCF margin at 33% in CY23



Source: BofA Global Research, Bloomberg

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Stock perf. more defensive than offensive

We examined historical stock performance and trading valuations of top diversified chipmakers, vs the SOX index. Diversified chipmakers underperformed the SOX but often did better than the S&P 500 Index (SPX) and S&P 500 Industrials. The past 5, 3 and 1 years SOX compounded at 30%, 16% and 61% annual pace. Diversified on avg compounded at 19%, 8% and 11% pace, better than the SPX and Industrial but trailing the SOX. On a rel basis, the auto industrial semis (IFX, STM, ON, Renesas) tended to do better in periods of stronger SOX performance, while indus. semis tended to outperform SOX when it declined, thus industrial semis are often more defensive than offensive.

Exhibit 38: Diversified semis have outperformed the S&P 500 index, but underperformed the SOX over the past 5 years

Annual and trailing 1,3,5 year performance of diversified semis vs SOX, SPX and SPX Industrial indices

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	YTD24	1-yr	3-yr	5-yr
SOX Index	14%	-12%	5%	39%	28%	-3%	37%	38%	-8%	60%	51%	41%	-36%	65%	12%	61%	16%	30%
SPX Index	13%	0%	13%	30%	11%	-1%	10%	19%	-6%	29%	16%	27%	-19%	24%	6%	30%	12%	15%
SPX Industrials	24%	-3%	12%	38%	8%	-5%	16%	19%	-15%	27%	9%	19%	-7%	16%	5%	22%	12%	12%
Top Diversified																		
Texas Inst.	25%	-10%	6%	42%	22%	3%	33%	43%	-10%	36%	28%	15%	-12%	3%	-4%	0%	1%	12%
Analog Devices	19%	-5%	18%	21%	9%	0%	31%	23%	-4%	38%	24%	19%	-7%	21%	-5%	5%	8%	14%
Microchip	18%	7%	-11%	37%	1%	3%	38%	37%	-18%	46%	32%	26%	-19%	28%	-8%	6%	5%	15%
NXP Semi		-27%	71%	75%	66%	10%	16%	19%	-37%	74%	25%	43%	-31%	45%	6%	41%	12%	23%
Onsemi	12%	-22%	-9%	17%	23%	-3%	30%	64%	-21%	48%	34%	108%	-8%	34%	-7%	2%	24%	28%
STMicro	13%	-43%	22%	10%	-7%	-11%	70%	92%	-36%	94%	38%	32%	-27%	41%	-11%	-5%	5%	22%
Infineon	68%	-19%	10%	31%	-2%	38%	18%	58%	-27%	12%	72%	19%	-34%	39%	-14%	2%	-5%	11%
Renesas									-61%	54%	53%	19%	-29%	104%	-4%	39%	16%	24%
Diversified Avg.	26%	-17%	15%	33%	16%	6%	34%	48%	-22%	50%	38%	35%	-21%	39%	-6%	11%	8%	19%
More Industrials Avg. (TXN, ADI, MCHP)	21%	-3%	4%	34%	11%	2%	34%	34%	-10%	40%	28%	20%	-13%	18%	-5%	4%	5%	14%
More Autos Avg. (Rest)	31%	-28%	8%	19%	5%	8%	40%	71%	-36%	52%	49%	44%	-25%	54%	-9%	10%	10%	21%
Diversified vs SOX																		
Overall vs SOX	11%	-5%	10%	-6%	-12%	9%	-3%	10%	-14%	-10%	-13%	-6%	15%	-25%	-17%	-50%	-8%	-11%
Industrial vs SOX	6%	9%	-1%	-6%	-18%	5%	-3%	-4%	-3%	-20%	-23%	-21%	23%	-47%	-17%	-57%	-12%	-16%
Autos vs SOX	16%	-16%	2%	-20%	-23%	11%	3%	33%	-28%	-8%	-2%	3%	11%	-11%	-21%	-51%	-6%	-9%
Diversified Semis vs SPX Industrials	2%	-14%	3%	-4%	9%	10%	18%	30%	-7%	23%	29%	16%	-14%	23%	-11%	-11%	-3%	7%

Source: BofA Global Research, Bloomberg

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Exhibit 39: Industrial semis tended to outperform SOX when it declined >10%

Relative performance of SOX index vs. more industrial and auto exposed semis when SOX declined more than 10%

Start Date	End Date	"Industrial" Semis						"Auto" Semis						
		SOX	TXN	ADI	MCHP	Avg	Vs. SOX		NXPI	ON	IFX	STM	Avg	Vs. SOX
4/26/2010	8/31/2010	-23%	-15%	-10%	-9%	-12%	12%			-27%	-24%	-32%	-28%	-4%
2/17/2011	8/19/2011	-31%	-32%	-25%	-23%	-27%	4%	-42%	-43%	-29%	-52%	-41%	-10%	
3/26/2012	7/17/2012	-20%	-22%	-10%	-14%	-15%	5%	-25%	-29%	-36%	-45%	-34%	-14%	
8/16/2012	11/20/2012	-11%	-3%	-2%	-17%	-7%	4%	-9%	-10%	-1%	-6%	-7%	5%	
7/16/2014	10/13/2014	-16%	-15%	-20%	-21%	-18%	-3%	-20%	-25%	-29%	-27%	-25%	-9%	
6/1/2015	2/16/2016	-21%	-6%	-24%	-15%	-15%	6%	-38%	-43%	-9%	-36%	-31%	-11%	
6/8/2017	7/3/2017	-10%	-9%	-8%	-13%	-10%	0%	0%	-17%	-7%	-17%	-10%	0%	
1/23/2018	2/8/2018	-13%	-19%	-14%	-19%	-17%	-5%	-4%	-17%	-15%	-16%	-13%	-1%	
3/12/2018	12/24/2018	-26%	-21%	-16%	-34%	-24%	2%	-45%	-44%	-36%	-47%	-43%	-17%	
4/24/2019	5/31/2019	-18%	-12%	-18%	-19%	-16%	2%	-12%	-23%	-25%	-19%	-20%	-1%	
2/13/2020	3/20/2020	-34%	-27%	-28%	-46%	-34%	0%	-47%	-50%	-53%	-48%	-49%	-16%	
2/18/2021	3/4/2021	-10%	-8%	-9%	-11%	-9%	1%	-10%	-7%	-11%	-16%	-11%	-1%	
4/12/2021	5/12/2021	-12%	-8%	-9%	-12%	-10%	3%	-12%	-16%	-13%	-11%	-13%	-1%	
12/27/2021	10/14/2022	-46%	-23%	-22%	-36%	-27%	20%	-41%	-17%	-51%	-39%	-37%	10%	
12/1/2022	1/3/2023	-11%	-8%	-5%	-12%	-8%	2%	-11%	-17%	-10%	-9%	-11%	-1%	
3/31/2023	4/25/2023	-10%	-9%	-8%	-11%	-9%	1%	-12%	-15%	-11%	-16%	-13%	-3%	
8/1/2023	10/30/2023	-17%	-21%	-22%	-24%	-22%	-5%	-24%	-40%	-33%	-30%	-31%	-14%	

Source: Bloomberg, BofA Global Research

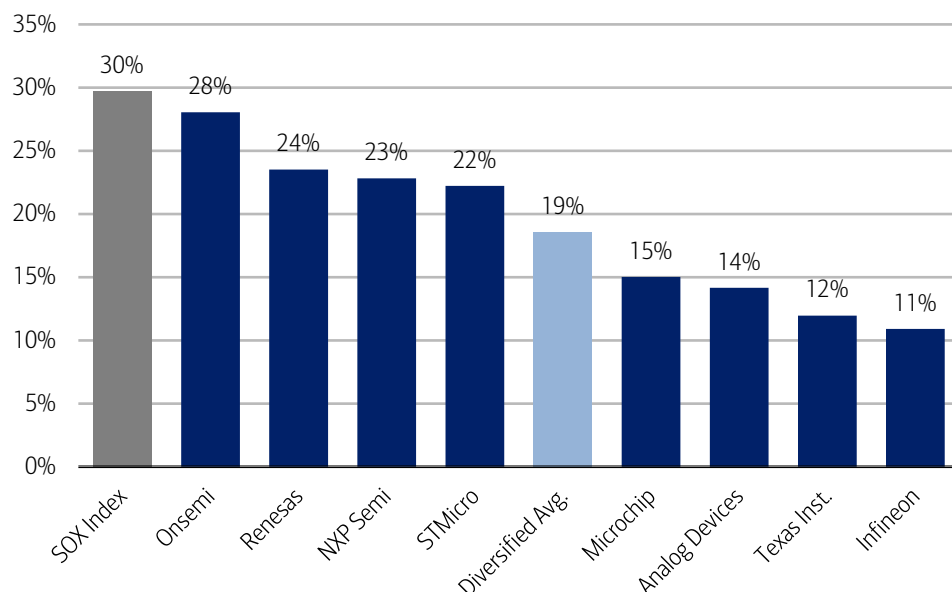
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Auto semis relatively stronger performers than more industrial semis

On a trailing 5-yr basis, all diversified companies underperformed the SOX index. However, on relative basis within the group, the more auto exposed semis such as ON (28% 5-yr annualized returns), Renesas (24%), NXP Semi (23%) and STMicro (22%), tended to outperform the diversified average, while the more industrial exposed semis Microchip, Analog Devices and Texas Inst. have tended to lag.

Exhibit 40: Annual stock returns (5-yr basis)

Diversified average saw 19% annualized returns over the past 5 years



Source: BofA Global Research, Bloomberg

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Diversified trading at discount to SOX

The diversified group on an average is currently trading at a 21.5x CY24E and 16.7x CY25E on a forward PE basis, below the SOX index trading at a 28x/20.8x PE multiple. The ongoing cyclical correction has depressed CY24E estimates, creating a nearly 27% premium for diversified stocks vs. their 5-yr median forward multiples. However, expectations for a strong rebound in CY25E compresses the premium to within historical norms. Currently TXN, ADI, NXPI, MCHP are trading at a premium to their historical 5-yr median multiple, while the remaining are trading at a discount.

Exhibit 41: Diversified trading at a discounted valuation to broader SOX index and 5-yr median

Forward PE multiple for diversified chipmakers based on consensus CY24E/CY25E estimates

	PE				Premium	
	CY24E	CY25E	3-yrMedian	5-Yr Median	CY24 vs 5-yr	CY25E vs 5-yr
TXN	30.6x	24.3x	22.3x	22.9x	34%	6%
ADI	32.3x	23.7x	19.2x	20.8x	55%	14%
NXPI	18.0x	15.9x	14.2x	14.3x	26%	11%
MCHP	31.2x	20.1x	13.7x	14.8x	111%	36%
IFX	15.5x	12.5x	15.0x	18.1x	-14%	-31%
STM	14.2x	11.1x	11.9x	14.7x	-3%	-24%
RENS	12.2x	10.7x	10.1x	13.2x	-8%	-19%
ON	18.1x	15.0x	16.5x	16.1x	12%	-7%
Average	21.5x	16.7x	15.4x	16.9x	27%	-2%
SOX Index	28.0x	20.8x	18.8x	18.4x	52%	13%

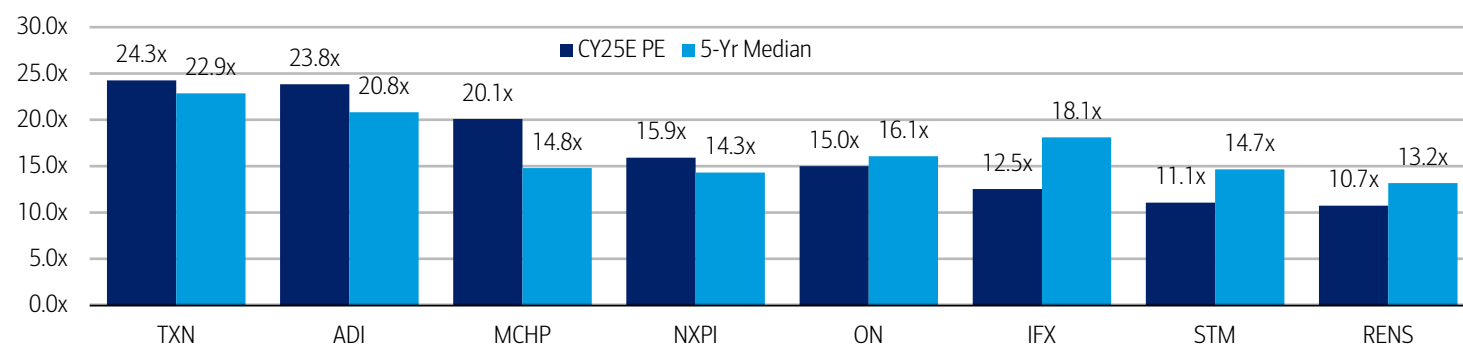
Source: Bloomberg, BofA Global Research Estimates

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Exhibit 42: CY25E PE vs 5-yr median

NXPI's CY25E PE multiple at 15.9x is slightly above the 5-yr median multiple (14.3x)



Source: BofA Global Research, Bloomberg

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Glossary:

ASP: Average Selling Price

MCU: Microcontroller

PE: Price/EPS

SOX: Philadelphia Semiconductor Index

TXN: Texas Instruments

ADI: Analog Devices

ON: onsemi

MCHP: Microchip

NXPI: NXP Semiconductors

STM: STMicroelectronics

IFX: Infineon

FCF: Free Cash Flow

OpM: Operating Margin

GM: Gross Margin

CAGR: Compound Annual Growth Rate

IC: Integrated Circuit

ASSP: Application-specific standard product

Si: Silicon

SIC: Silicon Carbide

SIA: Semiconductor Industry Association

CPU: Central Processing Unit

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Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

^{R1} Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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