### Semiconductor WEEK:

### January 06, 2023

### An overview of results and conclusions from recent reports at TechInsights

#### **Chip Market Research Services**

2023 is starting off with a blizzard

- Order activity for semiconductor equipment continued to decline, falling to a chilly 50 degrees
- IC Inventory Levels

#### **Semiconductor Analytics**

#### Last Week in the Semiconductor Market:

Semiconductor sales fell in a normal holiday dive, ending the last week 10% below 2021. The IC weather cooled 4°F over the holidays to Chilly conditions. Zooming in on 2022 results this week, the market ended the year bifurcated, with A&P and Auto in growth, logic flat, and memory in deep decline. Semiconductor sales grew 5% for year, reaching a record \$621B. TechInsights' IC Supply/Demand continued to loosen over the holidays. Overall conditions slid from tight to balanced, as Foundry slipped out of tight levels. More Moore Foundry went to Glut, as More than Moore Foundry slipped to Loose. DRAM also dropped back to Glut. OSAT and Analog & Power dropped to Balanced, while Auto ICs did a 1-week stint in Tight conditions – the first time since the week of February 11, 2022.

#### **Chip History Center**

**People: Mark Bohr,** Intel Fellow discusses process technology development on Intel's 65nm Process in this 2003 interview.

**Exhibits:** The Near Impossibility of Making a Microchip - This superb article, about the birth of the Perkin Elmer Projection Scanning Aligner, was first published in the Fall 1999 issue of American Heritage of Information & Technology.

#### **Semiconductor Stocks**

- TechInsights' Semiconductor Stock Indices grew this week with the exception of EDA stocks
- Semiconductor Stock Index rose
  - Western Digital was this week's biggest winner
- Semiconductor Equipment Stock Index jumped
  - BESI came out on top
- EDA Stock Index slipped
- Electronics Materials Stock Index increased
- Hottest Stocks: Western Digital, BASF, Amkor, Micron, SK hynix, and BESI

**TechInsights** 



# Manufacturing Analysis Conferences



G. Dan Hutcheson Vice Chair Techlnsights Dan is a Vice Chair of Techlnsights Inc. He is a recognized authority on the semiconductor industry, winning SEMI's Sales and Marketing Excellence Award in 2012 for "empowering executives with tremendous strategic and tactical marketing value" through his e-letter, *The Chip Insider*\*, his book *Maxims of Hi-Tech*, and his many interviews of executives.

As some industry leaders have said, "He is the marketing voice and expert for the industry". "Dan has methodically captured the essence of the industry and

produced it in such a way for all to benefit...He has been such an integral part of the industry for so long, it is difficult to imagine the industry without his contributions".

Dan's public work on the industry has often focused on challenging predictions of the demise of Moore's Law that date decades by demonstrating how doomsayers have been outpaced by emergent behavior through the innate ability of technologists to innovate. This has included invited articles for *Scientific American*, the *SIA*, and the Plenary at the *SPIE Advanced Lithography Conference*.

#### **Dan Hutcheson**

Monday, January 9<sup>th</sup>, 2023 11:50 am – 12:10 pm Session 1: Economic Trends Equipment Forecast

# INDUSTRY STRATEGY SYMPOSIUM —ISS 2023

January 8-11<sup>th</sup>, 2023 The Ritz Carlton Half Moon Bay, California, USA

# The Chip Insider®'s Graphics File





#### 2023 is starting off with a blizzard

- Order activity for semiconductor equipment continued to decline, falling to a chilly 50 degrees
- It should not come as a surprise that Memory is at freezing levels as chipmakers grapple with weak enddemand and severe levels of inventories
- TechInsights' Chip Price Performance Index continued to lose ground

Forecast as of December 2022:	2022	2023		
Semi Equipment (\$B):	\$ 136.9	\$ 118.1		
Sequential Change	7.9%	-13.7%		
Capacity Utilization:	95.0%	84.4%		
ICs (\$B):	\$ 513.6	\$ 483.8		
Sequential Change	4.3%	-5.8%		
IC Units (BU):	409.2	398.2		
Sequential Change	3.8%	-2.7%		
Electronics (\$B):	\$ 2,556	\$ 2,453		
Sequential Change	-0.7%	-4.1%		

#### Contact us to access more details

# The Chip Insider® Graphics

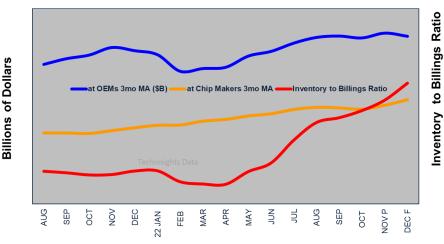
Billions

### IC Inventory Levels:

 Inventory-to-Billings ratio continues to warn

IC Inventory Levels: chart gives rolling averages for semiconductor integrated circuit inventories held at OEMs, in Die Banks, and the total Inventory-to-Billing Ratio

#### **Semiconductor Inventory**



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**TechInsights** 

#### Insights Interview:

# Workforce Development Solutions...

with Ajit Manocha of SEMI



#### What the conversation is about:

- Labor shortages have become the echo pandemic from the ravages COVID has had on the economy.
- This is no truer than in the semiconductor industry, where Workforce Development has long been on the To-Do lists of many.
- Most industry efforts appear to be more about lobbying others to do something about workforce development.
- It's really hard to do something substantive about it but SEMI is.

Click here to watch online



# Semiconductor Analytics

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Semiconductor sales fell in a normal holiday dive, ending the last week 10% below 2021. The IC weather cooled 4°F over the holidays to Chilly conditions. Zooming in on 2022 results this week, the market ended the year bifurcated, with A&P and Auto in growth, logic flat, and memory in deep decline.

Semiconductor sales grew 5% for year, reaching a record \$621B. TechInsights' IC Supply/Demand continued to loosen over the holidays. Overall conditions slid from tight to balanced, as Foundry slipped out of tight levels. More Moore Foundry went to Glut, as More than Moore Foundry slipped to Loose. DRAM also dropped back to Glut. OSAT and Analog & Power dropped to Balanced, while Auto ICs did a 1-week stint in Tight conditions – the first time since the week of February 11, 2022.



IC Weather Measures Order Activity S/D Measures Pricing Power



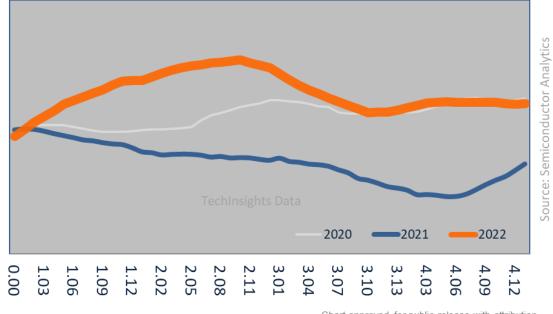
## Electronics Retail Pricing Trends:

for PC notebooks Tablets Smartphones Cell phones Digital Cameras Appliances TVs

Electronics' Retail Prices have peaked before the holidays.

#### **Electronics Pricing Barometer**

indexed 13 week moving average



Quarter.Week

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Semiconductors are to the information age what engines are to the industrial age. Chips are the steam engine, the internal combustion engine, and the fractional horsepower engine rolled up into one. The Chip History Center is dedicated to preserving that history for future generations.

People: Mark Bohr, Intel Fellow discusses process technology development on Intel's 65nm Process in this 2003 interview. It marks the first fully integrated 65nm process flow. The process was a fully featured process for MPUs including copper interconnect, second generation strained silicon, HKMG and more including their new D1D manufacturing fab...



#### **Exhibits**: The Near Impossibility of Making a Microchip:

This superb article, about the birth of the Perkin Elmer Projection Scanning Aligner, was first published in the Fall 1999 issue of American Heritage of Information & Technology. It describes a birth that was almost stillborn, but without which, today's step-and-scan exposure systems might not exist; nor would the super-complex chips at the heart of almost all electronic devices. Read the full article below to get a feel for the industry's struggles and how close it might have come to utter failure, but how it was saved by some of our industry's brightest stars.

















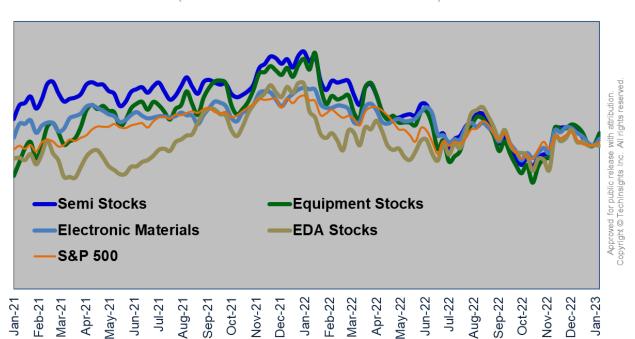


with the exception of EDA stocks.



#### **Semiconductor Industry Stock Performance Indices**

(Stock Prices Indexed to 100 in last week of 2022)



#### **TechInsights' Stock Indices:**

Semiconductors +5.3% Equipment +5.7% Electronic Materials +3.1% EDA -0.4%



### **Semiconductor Stocks:**

### Weekly Growth and Forward P/E Ratios by Company

Weekly Gains 1/6/2023									
Semiconductor Stocks	Price Change	Forw ard P/E	Semiconductor Stocks	Price Change	Forward P/E				
IDM			Fab-lite to Fabless						
Intel	8.7%	14	AMD	-1.3%	18				
Micron	13.6%	26	Analog Devices	0.9%	16				
ON Semiconductor	0.2%	14	Broadcom	5.2%	13				
Samsung Electronics	6.7%	_	IBM	2.0%	15				
SK hynix	10.8%		Infineon	8.5%	13				
STMicroelectronics	7.1%	10	MagnaChip Semiconductor	6.5%	35				
Western Digital	17.8%	8	MaxLinear	0.0%	9				
Foundry & OSAT			MediaTek	5.6%	_				
Amkor	14.2%	9	NVIDIA	1.7%	34				
ASE	6.4%	8	Panasonic	-1.0%	12				
GLOBALFOUNDRIES	-2.1%	24	Qualcomm	4.9%	9				
JCET	4.0%	13	Silicon Laboratories	5.0%	37				
SkyWater Technology	6.0%	_	Skyw orks	4.7%	8				
SMIC	1.1%	12	Texas Instruments	6.0%	21				
TSMC	4.8%	12							
UMC	7.0%	9							

TechInsights' Semiconductor Stock Index rose this week, Western Digital was this week's biggest winner buoyed by the rumors of a possible merger with Kioxia. Other top performers were Amkor, Micron, and SK hynix, which all ended with double-digit growth.

IDM +9.3% Foundry & OSAT +5.2% Fabless & Fablite +3.5%

AMD AMD Analog Devices ADI Amkor AMKR ASE ASX Broadcom AVGO GLOBALFOUNDRIES GFS IBM IBM Infineon IFNNY.PK Intel INTC JCET 600584.SS Micron Technology MU On Semiconductor ON Panasonic PC MagnaChip Semiconductor MX MaxLinear MXL MediaTek 2454.TW NVIDIA NVDA Qualcomm QCOM Samsung Electronics 005930.KS Silicon Laboratories SLAB SkyWater Technology SKYT Skyworks SMIC SMI STMicroelectronics STM Texas Instruments TXN TSMC TSM UMCUMC Western Digital WDC



# **Chip Equipment & Related Stocks:**

### Weekly Growth and Forward P/E Ratios by Company

Weekly Gains 1/6/2023											
Equipment Stocks	Price Change	Forward P/E	Equipment Stocks	Price Change	Forw ard P/E						
Wafer Fab:			Test:								
Applied Materials	7.1%	14	Advantest	0.4%	_						
ASM International	8.9%	22	Teradyne	4.5%	22						
ASML	9.1%	28	FormFactor	8.4%	27						
KLA	5.5%	20									
Lam Research	5.9%	15	Assembly:								
Onto Innovation	8.7%	_	BESI	9.3%	_						
Nikon	0.3%	_	Kulicke & Soffa	6.0%	12						
TEL	5.9%	_	ASM Pacific Technology	1.3%							
Veeco Instruments	4.1%	14									

Above Avg Top 4-6 Top 1-3

**TechInsights' Semiconductor Equipment Stock Index** jumped this week, all companies ended in positive territory with BESI coming out on top.

WFE +6.2% Test +4.4% Assembly +5.5%

Applied Materials AMAT Advantest ATEYY
ASM International ASMIY
ASM Lithography ASML ASM Pacific 0522.HK
BE Semiconductor BESIY.PK
FormFactor FORM KLA KLAC
Kulicke & Soffa KLIC Lam Research LRCX
Onto Innovation ONTO Nikon 7731 Teradyne
TER Tokyo Electron Limited 8035 Veeco
VECO



### **Electronic Materials Stocks:**

### Weekly Growth and Forward P/E Ratios by Company

Weekly Gains 1/6/202											
EDA & Electronic Materials Stocks	Price Change	Forward P/E	EDA & Electronic Materials Stocks	Price Change	Forw ard P/E						
EDA			DNP	-2.5%	_						
Cadence	-0.6%	34	DuPont de Nemours	5.6%	5						
Synopsys	0.4%	27	JSR	3.6%	_						
Ansys	-0.9%	29	Shin-Etsu	-0.7%	_						
Electronic Materials			SOITEC	-4.3%	_						
BASF	14.5%	2	Tokyo Ohka	1.0%	_						
Entegris	7.2%	19									

Above Avg Top 4-6 Top 1-3

**TechInsights' EDA Stock Index** slipped with only Synopsys ending in positive territory.

**TechInsights' Electronic Materials Stock Index** increased this week, BASF was the biggest winner with a double-digit growth compared to the next top performers, Entegris and DuPont de Nemours.

Ansys, Inc. ANSS BASF BASFY
Entegris ENTG Cadence CDNS DNP 7912
DuPont DD JSR 4185 Shin-Etsu 4063
SOITECSOLPA Synopsys SNPS Tokyo
Ohka 4186



The Prior		f Chip Indus	stry Stocks	ks Weekly Growth				panies Up Growth	nies	wth	g <sub>E</sub>	200	8 <b>£</b>		
Week's Close	Semi Stocks	Equipment Stocks	Materials Stocks	EDA Stocks	Semi Stocks	Equipment Stocks	Materials Stocks	EDA Stocks	Companies Up	Max Gro	Companies Down	Min Growth	Range of Growth	S&P 5	S&P 500 Growth
03-Jun-22	119.4	116.3	118.3	102.5	-0.3%	0.1%	1.9%	0.3%	29	7.7%	-26	-4.6%	12.3%	107.0	-1.2%
10-Jun-22	113.2	109.6	115.4	95.9	-5.2%	-5.7%	-2.5%	-6.5%	6	9.7%	-49	-11.9%	21.6%	101.6	-5.1%
17-Jun-22	104.7	98.0	105.1	92.4	-7.5%	-10.6%	-8.9%	-3.6%	2	4.0%	-53	-17.3%	21.3%	95.7	-5.8%
24-Jun-22	105.5	102.3	104.7	101.0	0.8%	4.3%	-0.3%	9.3%	41	12.8%	-14	-19.4%	32.2%	101.9	6.4%
01-Jul-22	97.7	92.0	101.3	95.4	-7.3%	-10.1%	-3.3%	-5.6%	3	6.1%	-52	-20.1%	26.2%	99.6	-2.2%
08-Jul-22	102.8	94.4	102.8	100.6	5.2%	2.7%	1.5%	5.5%	47	20.5%	-7	-4.8%	25.3%	101.6	1.9%
15-Jul-22	104.3	97.1	102.6	98.4	1.4%	2.8%	-0.2%	-2.2%	32	10.1%	-21	-9.1%	19.2%	100.6	-0.9%
22-Jul-22	108.9	105.9	108.5	105.8	4.4%	9.1%	5.7%	7.5%	52	66.7%	-3	-8.3%	75.0%	103.2	2.5%
29-Jul-22	111.4	109.4	110.8	115.3	2.4%	3.3%	2.1%	9.0%	39	12.4%	-16	-9.9%	22.3%	107.6	4.3%
05-Aug-22	114.8	113.6	108.7	116.9	3.1%	3.8%	-1.9%	1.5%	47	33.8%	-8	-17.1%	50.9%	108.0	0.4%
12-Aug-22	115.2	112.9	110.9	118.5	0.3%	-0.6%	1.9%	1.3%	33	22.3%	-22	-17.4%	39.7%	111.5	3.3%
19-Aug-22	111.1	109.2	108.7	114.2	-3.6%	-3.3%	-1.9%	-3.6%	9	17.4%	-46	-8.1%	25.5%	110.1	-1.2%
26-Aug-22	106.3	104.9	106.2	108.9	-4.3%	-3.9%	-2.3%	-4.7%	2	1.1%	-53	-17.8%	18.9%	105.7	-4.0%
02-Sep-22	100.6	97.0	101.7	103.0	-5.4%	-7.5%	-4.1%	-5.4%	1	2.1%	-54	-16.1%	18.2%	102.2	-3.3%
09-Sep-22	103.8	101.8	106.4	107.4	3.2%	4.9%	4.6%	4.2%	50	13.1%	-5	-9.5%	22.6%	105.9	3.6%
16-Sep-22	99.3	95.5	100.6	100.0	-4.3%	-6.2%	-5.4%	-6.9%	4	2.3%	-50	-24.2%	26.5%	100.9	-4.8%
23-Sep-22	93.8	90.3	97.1	96.6	-5.5%	-5.5%	-3.5%	-3.4%	3	1.6%	-52	-15.8%	17.4%	96.2	-4.6%
30-Sep-22	90.2	86.3	92.6	96.2	-3.9%	-4.4%	-4.7%	-0.4%	5	4.7%	-49	-11.7%	16.4%	93.4	-2.9%
07-Oct-22	93.5	90.2	96.2	95.0	3.7%	4.6%	3.9%	-1.3%	46	9.8%	-7	-7.8%	17.6%	94.8	1.5%
14-Oct-22	89.2	81.6	93.7	87.5	-4.6%	-9.5%	-2.6%	-7.9%	8	5.8%	-47	-16.1%	21.9%	93.3	-1.6%
21-Oct-22	93.6	89.5	96.2	93.2	4.9%	9.6%	2.8%	6.5%	45	21.9%	-10	-5.2%	27.1%	97.7	4.7%
28-Oct-22	95.3	93.3	98.6	92.8	1.8%	4.3%	2.5%	-0.5%	42	11.5%	-13	-24.7%	36.2%	101.6	4.0%
04-Nov-22	96.2	94.3	96.3	87.8	0.9%	1.0%	-2.4%	-5.3%	32	20.3%	-23	-21.5%	41.8%	98.2	-3.3%
11-Nov-22	107.8	108.4	107.2	104.5	12.1%	15.0%	11.3%	18.9%	53	37.4%	-2	-8.0%	45.4%	104.0	5.9%
18-Nov-22	108.3	107.5	106.2	101.9	0.5%	-0.8%	-0.9%	-2.5%	24	12.4%	-31	-22.2%	34.6%	103.3	-0.7%
25-Nov-22	108.5	108.1	108.7	103.4	0.2%	0.5%	2.4%	1.5%	36	5.6%	-19	-3.8%	9.4%	104.9	1.5%
02-Dec-22	108.7	109.9	108.2	107.6	0.1%	1.7%	-0.5%	4.0%	38	9.2%	-16	-7.5%	16.7%	106.0	1.1%
09-Dec-22	106.9	108.9	105.9	101.4	-1.7%	-0.9%	-2.1%	-5.7%	15	7.2%	-38	-8.5%	15.7%	102.5	-3.4%
16-Dec-22	103.6	105.8	104.1	101.7	-3.1%	-2.9%	-1.7%	0.3%	10	4.0%	-45	-10.6%	14.6%	100.3	-2.1%
23-Dec-22	100.4	100.0	100.9	99.7	-3.1%	-5.4%	-3.1%	-2.0%	3	1.2%	-51	-10.8%	12.0%	100.1	-0.2%
30-Dec-22	100.0	100.0	100.0	100.0	-0.4%	0.0%	-0.9%	0.3%	20	7.9%	-33	-5.3%	13.2%	100.0	-0.1%
06-Jan-23	105.6	105.5	103.1	99.6	5.6%	5.5%	3.1%	-0.4%	46	17.8%	-8	-4.3%	22.1%	101.4	1.4%

**TechInsights** 

# Links to **Conference Call** Transcripts

#### January 6<sup>th</sup>

Micron Technology, Inc. (MU) J.P. MORGAN 21ST ANNUAL TECH/AUTO FORUM (Transcript)

Marvell Technology, Inc. (MRVL) J.P. Morgan 21st Annual Tech/Auto Forum Conference (Transcript)

Skyworks Solutions, Inc. (SWKS) Presents at J.P. Morgan 21st Annual Tech/Auto Forum (Transcript)

NVIDIA Corporation (NVDA) J.P. Morgan 21st Annual Tech/Auto Forum Conference (Transcript)

ON Semiconductor Corporation (ON) CEO Hassane El-Khoury presents at J.P. Morgan CES Tech/Auto Forum (Transcript)

#### December 30th and before

Micron Technology, Inc. (MU) Q1 2023 Earnings Call Transcript

<u>Western Digital Corporation (WDC) CEO David Goeckeler Presents at Barclays 2022 Global Technology, Media and Telecommunications Conference (Transcript)</u>

Analog Devices, Inc. (ADI) Presents at Barclays 2022 Global Technology, Media and Telecommunications Brokers Conference (Transcript)

Marvell Technology, Inc. (MRVL) Arete Tech Conference (Transcript)

Western Digital Corporation (WDC) UBS Global TMT Conference Transcript

Advanced Micro Devices, Inc. (AMD) Arete Tech Conference (Transcript)

ASML Holding N.V. (ASML) Presents at UBS 2022 Global TMT Conference (Transcript)

NXP Semiconductors N.V. (NXPI) Presents at Nasdaq 47th Investor Conference (Transcript)



# Links to **Conference Call** Transcripts

ON Semiconductor Corporation (ON) NASDAQ 47th Investor Conference (Transcript)

NVIDIA Corporation (NVDA) Management Presents at Arete Tech Conference 2022 Conference (Transcript)

Western Digital Corporation (WDC) Arete Tech Conference (Transcript)

Marvell Technology, Inc. (MRVL) Q3 2023 Earnings Call Transcript

DuPont de Nemours, Inc. (DD) Presents at Credit Suisse's 10th Annual Global Industrials Brokers Conference (Transcript)

Semtech Corporation (SMTC) Q3 2023 Earnings Call Transcript

Synopsys, Inc. (SNPS) Q4 2022 Earnings Call Transcript

NXP Semiconductors N.V. (NXPI) 6th Annual Wells Fargo TMT Summit

Applied Materials, Inc. (AMAT) Presents at Wells Fargo 6th Annual TMT Summit Conference (Transcript)

NVIDIA Corporation (NVDA) Credit Suisse 26th Annual Technology Conference (Transcript)

Advanced Micro Devices, Inc. (AMD) Presents at Wells Fargo 6th Annual 2022 TMT Summit (Transcript)

Intel Corporation (INTC) Credit Suisse 26th Annual Technology Conference (Transcript)

Honeywell International Inc. (HON) Management Presents at Credit Suisse 10th Annual Global Industrials Conference (Transcript)

Western Digital Corporation (WDC) Credit Suisse 26th Annual Technology Conference (Transcript)

Micron Technology, Inc. (MU) 6th Annual Wells Fargo TMT Summit Conference (Transcript)

ON Semiconductor Corporation (ON) Management Presents At Credit Suisse 26th Annual Technology Conference (Transcript)



# Links to **Conference Call** Transcripts

Analog Devices, Inc. (ADI) Management Presents at Credit Suisse 26th Annual Technology Conference

NXP Semiconductors N.V. (NXPI) Credit Suisse 26th Annual Technology Conference (Transcript)

Qorvo, Inc. (QRVO) Presents at 6th Annual Wells Fargo TMT Summit

Lam Research Corporation (LRCX) Presents at Credit Suisse 26th Annual Technology Conference (Transcript)

Texas Instruments Incorporated (TXN) Credit Suisse 26th Annual Technology Conference (Transcript)

International Business Machines Corporation (IBM) Management Presents at Credit Suisse 26th Annual Technology

Conference Call Transcript

Analog Devices Inc. (ADI) Q4 2022 Earnings Call Transcript

Agilent Technologies, Inc. (A) Q4 2022 Earnings Call Transcript

Applied Materials, Inc. (AMAT) Q4 2022 Earnings Call Transcript

Camtek LTD. (CAMT) Q3 2022 Earnings Call Transcript

Kulicke and Soffa Industries, Inc. (KLIC) Q4 2022 Earnings Call Transcript

**NVIDIA Corporation (NVDA) Q3 2023 Earnings Call Transcript** 

Infineon Technologies AG (IFNNY) Q4 2022 Earnings Call Transcript

GLOBALFOUNDRIES Inc. (GFS) Q3 2022 Earnings Call Transcript

**Veeco Instruments, Inc. (VECO) Q3 2022 Earnings Call Transcript** 



## TechInsights recent uploads

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- Semiconductor Forecast V22.12
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- Electronics & Macroeconomy V22.10
- Diffusion Rates and Utilization V22.10
- Long-Term Semi and Eqpt Forecast V22.09
- Silicon Demand V22.09
- Advanced Packaging V22.07
- Packaging Demand V22.06

#### Equipment Database Module:

- Scanner & Stepper Shipments V22.12
- IC Equipment Forecast:
  - Yearly V22.08
- WFE Equipment Market Shares:
  - Yearly V22.05
  - Quarterly V22.12
- WFE by Applications V22.09

#### **Customer Satisfaction Survey Uploads:**

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- 2022 Survey Documents

#### **Critical Subsystems Uploads:**

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- Device Forecast Summary V22.11
- Manufacturing Equipment Forecasts V22.11
- Substrate Processing Equipment Shipments V22.11
- Substrate Processing Equipment Installed Base V22.11
- Chamber Shipments V22.11
- Supplier Shares V22.03

#### **Test Connectivity Reports:**

- Test and Burn-In Socket Report: V22.07
  - Quarterly Report: V22.12
- Probe Card Report: V22.05
  - Quarterly Report: V22.12
- Device Interface Board Report: V22.08
  - Quarterly Report: V22.12



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