Where Are We Going?

- Cycle Analysis 2023
- Looking Forward 2024
- What About the Electronics & Components Supply Chain?
- Economic Impact
- Driving the Future

Cycle Analysis

~ 2023 ~
Electronic Component Revenue Growth

Source: World Semiconductor Trade Statistics (WSTS), World Passive Trade Statistics (WPTS)
Semiconductors and Passive Comparisons

Worldwide Units Sold Semiconductors vs Passives

NEW YEAR – NEW GROWTH
Semiconductor Revenue Growth Cycle

- Quarter-over-Quarter growth accelerates to +11.6% at end of 2023
- Annual revenue cycle outperforms expectations; ends year on the upswing at -8.2%
- Annual growth improves in 2023 – How long can the positive growth last?
- Demand drivers continue to shift from consumer markets
- Asia achieving recovery to boost global picture
- Question – How well is the supply chain balanced?

Source – WSTS
Semiconductor Growth Trends

Quarter-over-Quarter Growth

Source: WSTS
Unified Downward Slide – No Market is Immune

- Memory ICs Amplifying / Distorting the Cycle
- Memory, Micro, and Logic ICs showing strong growth
- Analog ICs and Discretes moving countercyclical in negative territory
- Americas growth profile mirrors Worldwide trend at the end of 2023
- Pricing dynamic now shifts role to drive recovery

Source – WSTS

New Cycle Began in August 2023
After five months improves by 6.1% above the bottom

Source – WSTS

Note: Low point in current cycle is -14.3 in Aug '23
Looking Forward

~ 2024 + ~
Observations:

- 2023 Worldwide and Americas annual growth beat Fall ‘23 forecast.
- Fall WSTS presents broad based optimism for 2024. Double digit growth sustained into 2025.
- Higher Americas outlook driven by larger market share of Memory ICs
- Non-Memory market growth expected but at more subdued levels
- The cyclical pattern endures!
North America Sentiment Survey Trends

North American Sales Performance Compared to Prior Month

Source: ECIA Electronic Component Sales Trends Survey
# Semiconductor Forecasts

## Top Semiconductor Companies’ Revenue

<table>
<thead>
<tr>
<th>Company</th>
<th>US$B 4Q23</th>
<th>4Q23</th>
<th>Guidance 1Q24</th>
<th>Comments on 1Q 2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Nvidia</td>
<td>20.0</td>
<td>10.4%</td>
<td>n/a</td>
<td>4Q23 is guidance</td>
</tr>
<tr>
<td>2 Samsung SC</td>
<td>16.4</td>
<td>31.9%</td>
<td>n/a</td>
<td>growth in PC/mobile</td>
</tr>
<tr>
<td>3 Intel</td>
<td>15.4</td>
<td>8.8%</td>
<td>-17.6%</td>
<td>excess inventory</td>
</tr>
<tr>
<td>4 Broadcom</td>
<td>9.3</td>
<td>-0.3%</td>
<td>n/a</td>
<td>4Q23 is guidance</td>
</tr>
<tr>
<td>5 SK Hynix</td>
<td>8.6</td>
<td>24.7%</td>
<td>n/a</td>
<td>growth in PC/mobile</td>
</tr>
<tr>
<td>6 Qualcomm (IC)</td>
<td>8.4</td>
<td>14.2%</td>
<td>-6.2%</td>
<td>down due to seasonality</td>
</tr>
<tr>
<td>7 AMD</td>
<td>6.2</td>
<td>6.3%</td>
<td>-12.5%</td>
<td>down except data center</td>
</tr>
<tr>
<td>8 Micron</td>
<td>4.7</td>
<td>17.9%</td>
<td>12.1%</td>
<td>DRAM &amp; NAND growth strong</td>
</tr>
<tr>
<td>9 STMicro</td>
<td>4.3</td>
<td>-3.4%</td>
<td>-15.9%</td>
<td>industrial inventory excess</td>
</tr>
<tr>
<td>10 TI</td>
<td>4.1</td>
<td>-10.0%</td>
<td>-11.7%</td>
<td>weakness in industrial</td>
</tr>
<tr>
<td>11 MediaTek</td>
<td>4.0</td>
<td>17.7%</td>
<td>-3.0%</td>
<td>mobile down</td>
</tr>
<tr>
<td>12 Infineon</td>
<td>3.7</td>
<td>-10.2%</td>
<td>-2.8%</td>
<td>industrial inventory excess</td>
</tr>
<tr>
<td>13 NXP</td>
<td>3.4</td>
<td>-0.3%</td>
<td>-8.7%</td>
<td>seasonality &amp; inventory</td>
</tr>
<tr>
<td>14 Analog Devices</td>
<td>2.5</td>
<td>-8.0%</td>
<td>n/a</td>
<td>4Q23 is guidance</td>
</tr>
<tr>
<td>15 Renesas</td>
<td>2.5</td>
<td>-4.6%</td>
<td>-4.7%</td>
<td>industrial inventory excess</td>
</tr>
</tbody>
</table>

**Total of above**: 11%

**Memory Cos. (US$)**: 33% (Samsung, Hynix, & Micron)

**Non-Memory Cos.**: 4% (-11%)

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## Semiconductor Market Forecasts

<table>
<thead>
<tr>
<th>Source</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
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</thead>
<tbody>
<tr>
<td>WSTS, Nov.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.1%</td>
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<td>Gartner, Dec.</td>
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<td>16.8%</td>
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<tr>
<td>TechInsights (IC)</td>
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<td></td>
<td></td>
<td></td>
<td>17%</td>
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<tr>
<td>Objective Analysis</td>
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<td>5%</td>
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<td>IDC, Dec.</td>
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<td></td>
<td>20%</td>
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<tr>
<td>Strategic Semiconductors, Jan.</td>
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<td></td>
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<td>10.5%</td>
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<td>Future Horizons, Jan.</td>
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<td>16%</td>
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<tr>
<td>Deloitte, Jan.</td>
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<td></td>
<td>13%</td>
<td></td>
<td></td>
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<tr>
<td>Semiconductor Intelligence, Feb.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18%</td>
</tr>
</tbody>
</table>

Source: Semiconductor Intelligence
Long Term Trend = $1 Trillion by 2033
What About the Electronics Components Supply Chain?

~ Worldwide / Americas~
Worldwide Semiconductor Unit Shipments

Source: WSTS

Increase From:
• Discretes -11.7%
• Analog ICs 1.4%
• Logic ICs -9.6%

Previous Peak
• Discretes -11.7%
• Analog ICs 23.2%
• Logic ICs 5.8%

Recovery Start
• Discretes 9.2%
• Analog ICs 23.2%
• Logic ICs 5.8%

Source: WSTS
An ASP Driven Semiconductor Cycle

ASP Growth as of December 2023 Since January of Each Year

- Discretes
- Optoelectronics
- Sensors & Actuators
- Analog ICs
- Microcomponents
- Logic ICs
- Memory ICs
- Total Semiconductors

2021, 2022, 2023

Source: WSTS
Americas Semiconductor Unit Shipments

Increase From:

- Discretes          41.9%       97.1%
- Monolithic ICs           22.3%          46.9%

Source: WSTS
Hopeful Outlook for Moderating Pressure

Product Lead Time - December to January Comparison

- Dec - EM / Connectors
- Jan - EM / Connectors
- Dec - Passives
- Jan - Passives
- Dec - Semiconductors
- Jan - Semiconductors
- Dec - Overall Average
- Jan - Overall Average

Lehigh University Supply Chain Risk Index – Q1 2024
NAM Q4 2023 Manufacturers’ Outlook Survey
- More than 66% of member companies have a positive economic outlook for 2024
- Opinions are mixed on whether there will be a recession.

The top economic challenge this year will be the workforce, with the labor market cooling substantially but remaining tight, Moutray said.

Private manufacturing construction spending is at an all-time high of $210 billion
- Thanks to the production of semiconductors, electric vehicles and batteries, and general reshoring.

Risks this year include:
- Geopolitical turmoil
- Slow global economic growth
- Cost pressures
- Talk of a recession
- Labor issues

The Conference Board Leading Economic Indicator (LEI)

The LEI still declined in January 2024 but at the slowest pace since March 2023.

Peaks and troughs:
- 01:3   01:11
- 07:12  09:6
- 20:2   20:4

Sources: The Conference Board, *Bureau of Economic Analysis (BEA)

Note: Shaded areas represent recessions as determined by the NBER Business Cycle Dating Committee.
Inflation Falls from 40 Year High

Source – Bureau of Labor Statistics (BLS)
The Danger of History Repeating

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Technology – Need for Speed and Power

EVs That Go 1,000 Miles on a Single Charge

Near-Unlimited Energy Commercial Fusion Energy

First Operational Graphene-Based Chip Ten Times Faster Than Silicon

Universal Memory Emerges to Replace RAM and NAND - ULTRARAM

Nanotech Material Passes Human Safety Tests
Thank you!

Dale Ford – Chief Analyst
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