Midpoint Outlook

- Top Americas Authorized Distributors
- Cycle Analysis
- Looking Forward ~ 2021
- What About the Electronics & Components Supply Chain?
- Electronics & Components Market Drivers
**Top 50 North America Authorized Distributors - 2020**

**ECIA / Electronics Sourcing Partnership**

**Distribution minimizes 2020 losses as it stabilizes supply chain**

Amid pandemic turbulence North American distributors see revenues slide for second straight year but contain decline to -8.9% in volatile supply chain environment

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**The Top 50 North America Authorized Distributors**

<table>
<thead>
<tr>
<th>Rank 2020</th>
<th>Rank 2019</th>
<th>2020 North America Sales (in millions)</th>
<th>Growth 2020/2019 (%)</th>
<th>Share of Top 50 Total Sales (%)</th>
<th>North America Sales Share of Total Revenue (%)</th>
<th>Type*</th>
<th>Active</th>
<th>Passive</th>
<th>Hybrid</th>
<th>Interconnect</th>
<th>Computer Products</th>
<th>Other</th>
<th>Total Employees</th>
<th>Sales per Employee (in millions)</th>
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<td>76.0</td>
<td>3.4</td>
<td>2.4</td>
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<td>2.0</td>
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<td>5.0</td>
<td>3.0</td>
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</table>
Industry growth drivers - Beyond technology

Supply chain imbalances and extending lead times

Securing the supply chain becomes a top priority

The value of distribution highlighted

Shipping, logistics and freight – oh my!

Reshaping markets in the near and long-term

Transformations in workplaces and workforce support

Digital technology – Supply Chain wins and opportunities

# The Top 50

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>2020 North America Sales ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arrow Electronics, Inc. (2)</td>
<td>6,183.1</td>
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<tr>
<td>2</td>
<td>Avnet (Includes Farnell) (2)</td>
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<td>Future Electronics (1)</td>
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<td>TTI</td>
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<td>6</td>
<td>Mouser Electronics</td>
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<tr>
<td>7</td>
<td>DAC / Helind</td>
<td>796.0</td>
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<td>8</td>
<td>Allied Electronics/RS Components</td>
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<tr>
<td>9</td>
<td>Sager</td>
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<tr>
<td>10</td>
<td>Master Electronics (1)</td>
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<tr>
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<td>Bisco Industries, Inc.</td>
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<td>WPG Americas Inc.</td>
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<td>PEI-Genesis (3)</td>
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<td>Fuses Unlimited (1)</td>
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<td>CDM Electronics (1)</td>
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<td>Brevan Electronics</td>
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<td>35</td>
<td>Beyond Components (1)</td>
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<td>Diverse Electronics</td>
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<td>NASCO Aerospace &amp; Electronics</td>
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<td>Flip Electronics</td>
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<td>Benchmark Connector Corporation</td>
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<td>Sherburn</td>
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<td>50</td>
<td>East Coast Microwave (1)</td>
<td>14.8</td>
</tr>
</tbody>
</table>

**TOTAL TOP 50**: 21,438

(1) ECIA Estimate for Total North America Sales and Sales Breakdown • (2) ECIA Estimate for Sales Breakdown • (3) ECIA Estimate for Total North America Sales

Distribution Revenue Growth and Geographic Share

Top 50 Total Revenue Share by Region - 2020

- Americas: 52.4%
- EMEA: 27.3%
- Asia: 20.3%

Total Revenue = $78.6 B

Top 50 Total Revenue Share by Region - 2019

- Americas: 47.2%
- EMEA: 30.3%
- Asia: 22.6%

Total Revenue = $75.3 B

Total Revenue of Top 50 Authorized North America Distributors

<table>
<thead>
<tr>
<th>Year</th>
<th>Millions of Dollars</th>
</tr>
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<tbody>
<tr>
<td>2010</td>
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<td>2019</td>
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<tr>
<td>2020</td>
<td>25,000</td>
</tr>
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Electronic Components Industry Association
Revenue Share by Component and Rank

North America Revenue Share by Rank

- **2020**
  - Total Revenue = $21.4 B
  - Arrow & Avnet: 50.6%
  - Rank 21 to 30: 9.0%
  - Rank 3 to 10: 6.7%
  - Rank 11 to 20: 4.6%
  - Rank 41 to 50: 2.6%

- **2019**
  - Total Revenue = $22.8 B
  - Arrow & Avnet: 53.2%
  - Rank 21 to 30: 9.5%
  - Rank 3 to 10: 6.6%
  - Rank 11 to 20: 3.6%
  - Rank 41 to 50: 2.4%

North America Revenue Share by Component

2020
- Semiconductors: 52.6%
- Interconnect: 13.2%
- Passive: 9.0%
- Electro-mechanical: 6.6%
- Computer / Systems: 5.6%
- Other: 20.7%

2019
- Semiconductors: 53.9%
- Interconnect: 8.8%
- Passive: 9.1%
- Electro-mechanical: 4.5%
- Computer / Systems: 5.6%
- Other: 20.0%

Total Revenue = $22.8 B

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Electronic Components Industry Association
Revenue by Customer and End Market

North America Revenue by End Market – 2020

North America Customer Revenue Share – 2020

Total Revenue = $21.4 B

Electronic Component Distribution Growth Drivers

2021 Technology Sales Growth Driver Average Ratings

- Electric Vehicles (EV/HEV)
- 5G
- Internet of Things (IoT)
- Green/Renewable Energy
- Smart Grid / Smart Meters
- Energy-Efficient Lighting
- Autonomous Vehicles
- Artificial Intelligence (AI)
- Virtual/Augmented Reality (VR/AR)
- Active Matrix Micro LED TVs
- Foldable Displays

Average Rating (Range 0 to 10)
Semiconductor Revenue Growth Cycle

- 2021 Growth Surging
- Qtr-over-Qtr tops 20% in April
- Annual revenue growth profile continues steady and tops 10%
- No indication at this point of a slowing in the growth cycle
- Based on the current trend it would appear this cycle will top the peak in 2018
- Could supply limitation be the primary cause of a slowdown?

Source – WSTS

Electronic Component Revenue Growth

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

Semiconductor Growth Trends

Quarter-over-Quarter Growth

Source: WSTS
Different Trends for Different Markets - Alignment Diverging

- Every component category achieving strong upward qtr-over-qtr growth
- Typical cycles do not exhibit this type of growth alignment
- With stable pricing even memory has returned to strong growth starting in 2021
- Microcomponents are showing the lowest growth – but MCUs in strong demand

Source – WSTS
Americas Semiconductor Market Rejoins Growth

- With renewed memory growth Americas has now joined other regions in growth
- EMEA achieves a remarkable turnaround in growth – now only behind Asia/Pac
- Japan sustains strong growth after stagnation

Source – WSTS

Solid Start to Current Cycle

Current cycle showing both strength and endurance

Source – WSTS
Observations:

- Forecast built up category-by-category with experienced analysts from all regions
- Follows a typical semiconductor cycle pattern
- Americas skewed by Memory IC dynamics
- BUT – there are indicators that the current cycle will be stronger and more durable than common expectations
- Also, WSTS data has yet to reflect recent price increases
Semiconductor Revenue Growth Cycle

GDP Relationship

- Current Cycle – Global GDP creates drag on semiconductor growth
- Technology/Market forces aligning to support growth in 2020+

Source: IHS Markit, OMDIA, IMF Forecast averages

North America Sentiment Survey Trends

- All segments cooling from their Apr to Jun highs – BUT still growing!
- Is this driven by supply limitations or end markets?
- Important to remember context – Month compared to prior Month
- Above 100 means continued improvement – Like keeping foot on accelerator

Source: ECIA Electronic Component Sales Trends Survey
Optimism abounds!

- Broad-based confidence across the market
- Industrial, Telecom Networks & Automotive lead in optimism
- Between 55% and 75% growth expectation range across individual markets
- Percent of respondents expecting overall market growth = 77%
North America Sentiment Survey Trends

- Not a cloud in the sky!
- Positive growth expectations range between 77% and 88% of survey respondents
- Semiconductors & Capacitors see the strongest expectations in growth above 5% followed by Connectors & Electro-Mechanical
- Percent of respondents expecting overall market growth = 79%

Source: ECIA Electronic Component Sales Trends Survey
Quarterly DTAM Estimates

Total Americas Electronic Component DTAM Revenue

- **Revenue (Billions of Dollars)**
  - Q1 2019: 6.0
  - Q2 2019: 5.8
  - Q3 2019: 5.6
  - Q4 2019: 5.4
  - Q1 2020: 5.2
  - Q2 2020: 5.0
  - Q3 2020: 5.2
  - Q4 2020: 5.4
  - Q1 2021*: 5.6

- **Growth (%)**
  - Q1 2019: 4%
  - Q2 2019: 2%
  - Q3 2019: 0%
  - Q4 2019: -2%
  - Q1 2020: -4%
  - Q2 2020: -6%
  - Q3 2020: -8%
  - Q4 2020: -10%
  - Q1 2021*: 0%

**Source:** ECIA
Americas Quarterly DTAM and TAM Growth Comparison

Source: ECIA / WSTS
Americas Quarterly DTAM and TAM Growth Comparison

Source: ECIA / WSTS
What About the Electronics & Components Supply Chain?
North America Lead Time Trends – Record Setting

Source: ECIA
Minor Index Decline

• Like temperature falling from 120° to 115° - still blazing hot!
• On average 69% see increasing / No reported decreases
• 78% of Mfr Reps report increasing

Index Calculation Formula = (%Decreasing * 0) + (%Stable * 100) + (%Increasing * 200)

Source: ECIA
Lead Time Status – ECIA Member Quarterly Survey

Current Lead Time - Q2 2021

- Capacitors
- Connectors
- Electro-Mechanical
- Inductors
- Resistors
- Semiconductors
- Memory
- MPU
- MCU
- Analog/Linear IC
- Discretes

Source: ECIA

Critical Inventory Levels in Every Category

Source: ECIA

Current Inventory Levels

- Capacitors
- Inductors
- Resistors
- DRAM
- NAND Flash Memory
- Analog/Linear IC
- MPUs
- MCUs
- Discrete

Source: ECIA

Index of North American Components Orders Received
Index Based on Average Week of Previous Year

Source: ECIA
Worldwide Semiconductor Unit Shipments

Source: WSTS

Increase From: Previous Peak Recovery Start
• Discretes 10.6% 36.8%
• Analog ICs 7.8% 31.0%
• Logic ICs 20.3% 40.8%
Americas Semiconductor Unit Shipments

Increase From:
- Discretes: 42.9% 98.5%
- ICs: 9.9% 32.1%

Source: WSTS
Worldwide Annualized Semiconductor Revenue

Growth Swings

- Jun ‘16 to Nov ’18
  - 29 Months
  - +$146B; +45%
- Nov ’18 to Nov ’19
  - 12 Months
  - -$60B; -13%
- Nov ’19 to Apr ’21
  - 17 Months
  - +$57B; +14%

^Volatility = ^Risk
^Risk = ^Required ROI
The Challenge of Balancing CAPEX

Surge vs Steady State

- Strong addition of fab capacity in 2020 still outstripped by surge in demand starting in H2 2020
- Added CAPEX investments by major fabs announced
  - But, building new fabs typically takes 18 to 36 months
- Will steady state demand settle back and eventually leave industry with excess capacity?
- This is the continual semiconductor industry challenge and a driver of the cycle

Wafer Supply Challenges

Constrained wafer supply through 2024 likely

- 300 mm prime wafer demand will be at >99% of utilization production capacity in 2022
- 300 mm wafer production capacity will need to expand by 6% or more over the next two years to avoid a shortage
- No new plants announced, if investment starts today new capacity will not happen until 2024 at the earliest.
- New greenfield investments will require LTAs based on higher pricing

Semi Materials Market to Grow ~7% in 2021

- Localism is an ongoing global trend, with China, the European Union, South Korea, Taiwan, and the United States all investing in electronic materials capacities
- Critical materials for the fabrication of advanced logic and memory chips such as cobalt and lanthanum have been in short supply
Meeting the Wafer Supply Challenges

Fab Construction Plans

- 19 new high-volume fabs by the end of 2021 and break ground on another 10 in 2022. 300 mm wafer production capacity will need to expand by 6% or more over the next two years to avoid a shortage
- Equipment spending expected to surpass $140 billion over the next few years

Plans for Record Setting 200 mm Wafers

- Semiconductor manufacturers worldwide are on track to boost 200mm fab capacity by 950,000 wafers, or 17%, from 2020 through 2024 to reach a record high of 6.6 million wafers per month
- Investments projected to remain above $3 billion in 2022. Foundry accounting for more than half of the spending, followed by discrete/power at 21%, analog at 15%, and MEMS and sensors at 7%.
Materials Supply Issues

• US wet chemical supply capacity and demand volumes are running so closely that any plant shut-down or appreciative increase in demand can cause a shortage

• Several semiconductor process materials in the petroleum supply-chain are running short because of lower overall oil refinery further impacted by the Texas snowstorm
  • Materials including acetone, PGMEA, NMP, and IPA, a few of several solvents, rely on the petrochemical refinery supply-chain
  • Specialty polymers used to make photoresist, and CMP pads are also part of this chain, although used in lower volumes than solvents
  • Plastics production, required by high purity chemical providers for packaging and wet processing equipment, is experiencing raw material price increases due to availability issues

• Most advanced IC fabs for logic and memory chips require purity levels in materials so extreme that trace contaminants below parts-per-billion can cause millions in dollars of commercial yield losses

Raw Material Pricing Trends – IHS Markit Index

• Index declined in seven of the past 13 weeks
• Prices dropped for eight out of ten subcomponents
• Prices 94% above last year's levels
• Prices up 18% since the beginning of 2021
Supply Chain Challenges Abound

*One example – Shenzhen Port a Major Bottleneck*

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<th>Departures</th>
<th>Arrivals</th>
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<td>16. Jun</td>
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<tr>
<td>17. Jun</td>
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<tr>
<td>22. Jun</td>
<td>479</td>
</tr>
<tr>
<td>23. Jun</td>
<td>482</td>
</tr>
</tbody>
</table>

- **Passenger**: 1.62%
- **Fishing**: 0.23%
- **Search and Rescue**: 0.02%
- **Unspecified**: 0.29%
- **Pleasure Craft**: 0.04%
- **Other**: 0.89%
- **Cargo**: 83.03%
- **Special Craft**: 4.96%
- **Tanker**: 2.05%
- **Tug**: 6.82%
### Lehigh University Supply Chain Risk Index – Q2 2021

#### Risk Type

<table>
<thead>
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<th>Risk Type</th>
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<th>Last Quarter Risk Index</th>
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<tr>
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#### Risk Type

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Source: Lehigh Univ, CSCMP
### Connected and autonomous supply chain ecosystems 2025

**Digital – Physical Integration**

#### 2020- The Gartner Supply Chain Top 25

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<tr>
<th>Rank</th>
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<th>Rank</th>
<th>Company</th>
<th>Rank</th>
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<td>L’Oreal</td>
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<td>H&amp;M</td>
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</tbody>
</table>

#### Digital Champions

- Aggressively invest in digital supply chain technologies - achieve operational savings of 6.8% annually in supply chain costs
- The same companies are posting 7.7% annual revenue increases
- 28% say they now have more effective risk management due to their advanced supply chain capabilities

Study by PwC
Will “Bifurcation” Avoid Balkanization?

• Asymmetric Competition: A Strategy for China & Technology
  • Proposal produced by group formed by Eric Schmidt and Jared Cohen
  • Schmidt refers to proposal as “Bifurcation”

• “Advances policies that position the U.S. to out-compete China without inviting escalatory cycles of confrontation, retaliation, or unintended conflict”

• **Functional Capabilities**  a core part of proposal
  • **Supply Chains.** Building more resilient supply chains is critical to diminishing our vulnerability to Chinese control, but will require significant investment in domestic infrastructure, ally-centric production, and advances in automation.”

• **Next Generation Chips** – Defined as “Critical Technology” in “Technological Battleground”
The Push to Rebuild US Semiconductor Manufacturing

CHIPS for America Act

• Bipartisan support
• $52 billion semiconductor investment over next 5 to 10 years
• Includes a range of federal investments to advance U.S. semiconductor manufacturing
  • $10 billion for a new federal grant program that would incentivize new domestic semiconductor manufacturing facilities
  • Refundable investment tax credit for the purchase of new semiconductor manufacturing equipment and other facility investments
  • Significant federal investments at the Department of Defense, the National Science Foundation, and the Department of Energy to promote semiconductor research and drive chip technology breakthroughs
  • Establish a National Semiconductor Technology Center to conduct research and prototyping of advanced chips, as well as create a center on advanced semiconductor packaging.
• Congressional legislation died in the last congress
A Pan-American Manufacturing Ecosystem

HBR Article by Bindiya Vakil, Tom Linton, and Dale Rogers

• Build a reliable, cost-effective land-based transportation network that connects the three Americas

• Only with strong partnerships and a Pan-American transportation network will the United States be able to bring manufacturing home from Asia

• Would benefit all involved
  • Creating jobs and promoting political stability in poor countries
  • Build wealth in these nations
  • Slow migration from them to the United States.

• Leveraging Mexico’s and Central America Younger Populations

• Finding Sources of Renewable Water

• Constraining China and Russia

• Modernizing the Pan-American Transportation Network

BUT – There are Challenges
Demographics as a Factor in Regional Strength

Percent of the Population in the 0 to 14 Age Cohort, Key East Asia and Pacific Countries, 2019

Percent of the Population in the 0 to 14 Age Cohort, North America, 2019

Percent of the Population in the 0 to 14 Age Cohort, Sub-Saharan Africa, 2019

Percent of the Population in the 0 to 14 Age Cohort, Latin America and the Caribbean, 2019

Source(s): World Bank, World Development Indicators
Electronics & Components
Market Drivers
Growth Drivers for Semis & IP&E Components

• New technologies enable/drive new system and network architectures

• Creation of new classes and categories of devices

• Motivator to upgrade and enhance current installed base of electronics
  - Commercial AND consumer / Competition

• Pressure on next level performance from devices through networks
  - GaN & SiC devices, process geometry shrinks, sensors, processing architectures, energy harvesting…

  Technology / Market Disruption Will Create an Explosion in New Design Win Opportunities
Thank you!

Dale Ford – Chief Analyst
dford@ecianow.org