



**SWTEST**

PROBE TODAY, FOR TOMORROW

# **Welcome to the 29<sup>th</sup> Annual SWTest Conference in San Diego**

**Jerry Broz, Ph.D.  
SWTest General Chair**

June 2-5, 2019



# Welcome Rancho Bernardo Inn !





# Semiconductor Wafer Test – SWTest

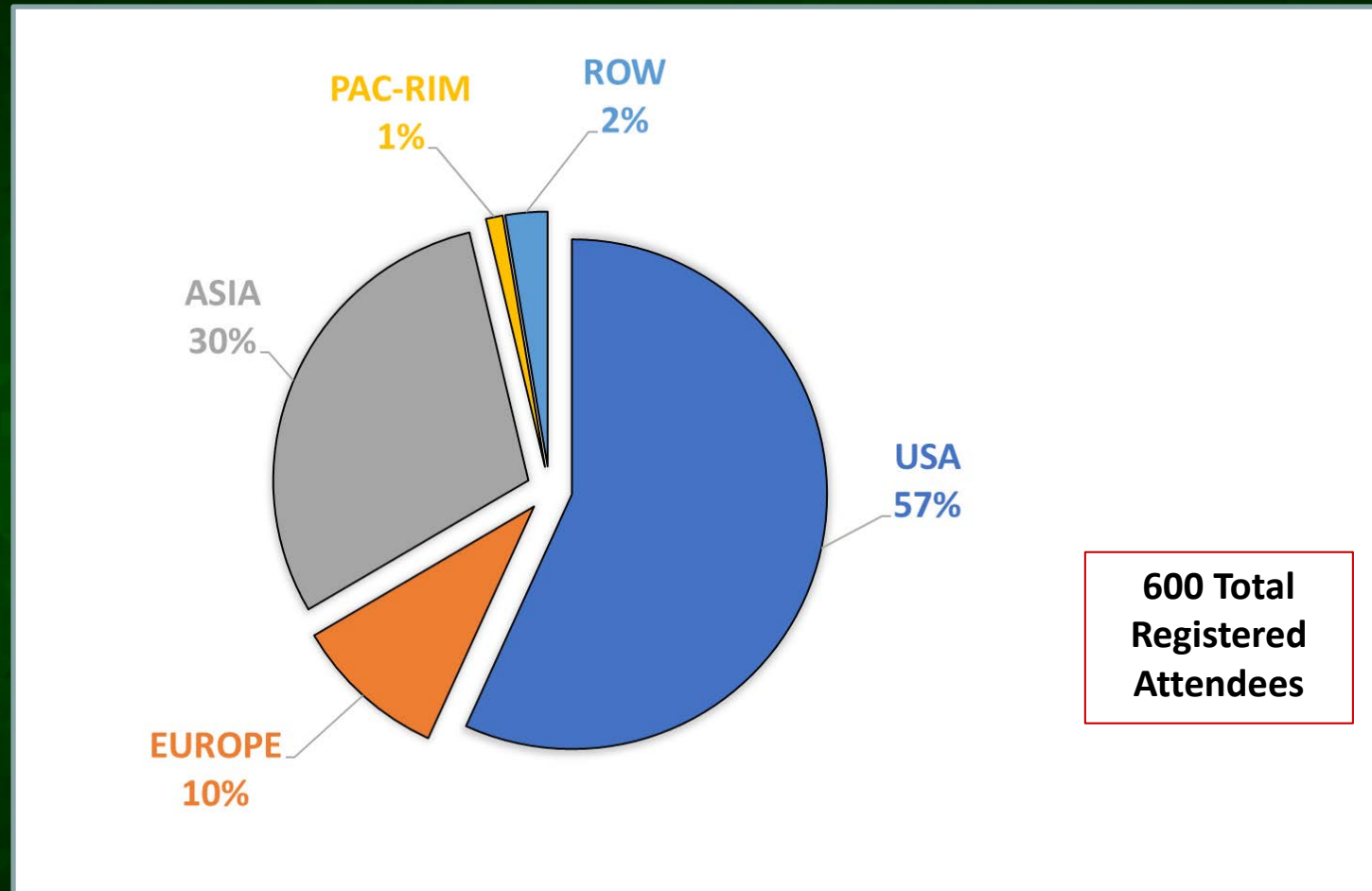
- **SWTest IS a Probe Technology Forum ...**
  - It is “THE” Conference for Wafer Test Professionals
  - Practical solutions to real problems
  - Balanced mixture of semiconductor manufacturer, and supplier as well as collaborative presentations
- **Informal Conference ...**
  - Grass roots Conference style conference that is focused technical exchange
  - Great social activities and informal discussions
  - Meet new people and have a little fun !

# A New Look for 2019 !

More than 9500+ total attendees in 29 years !

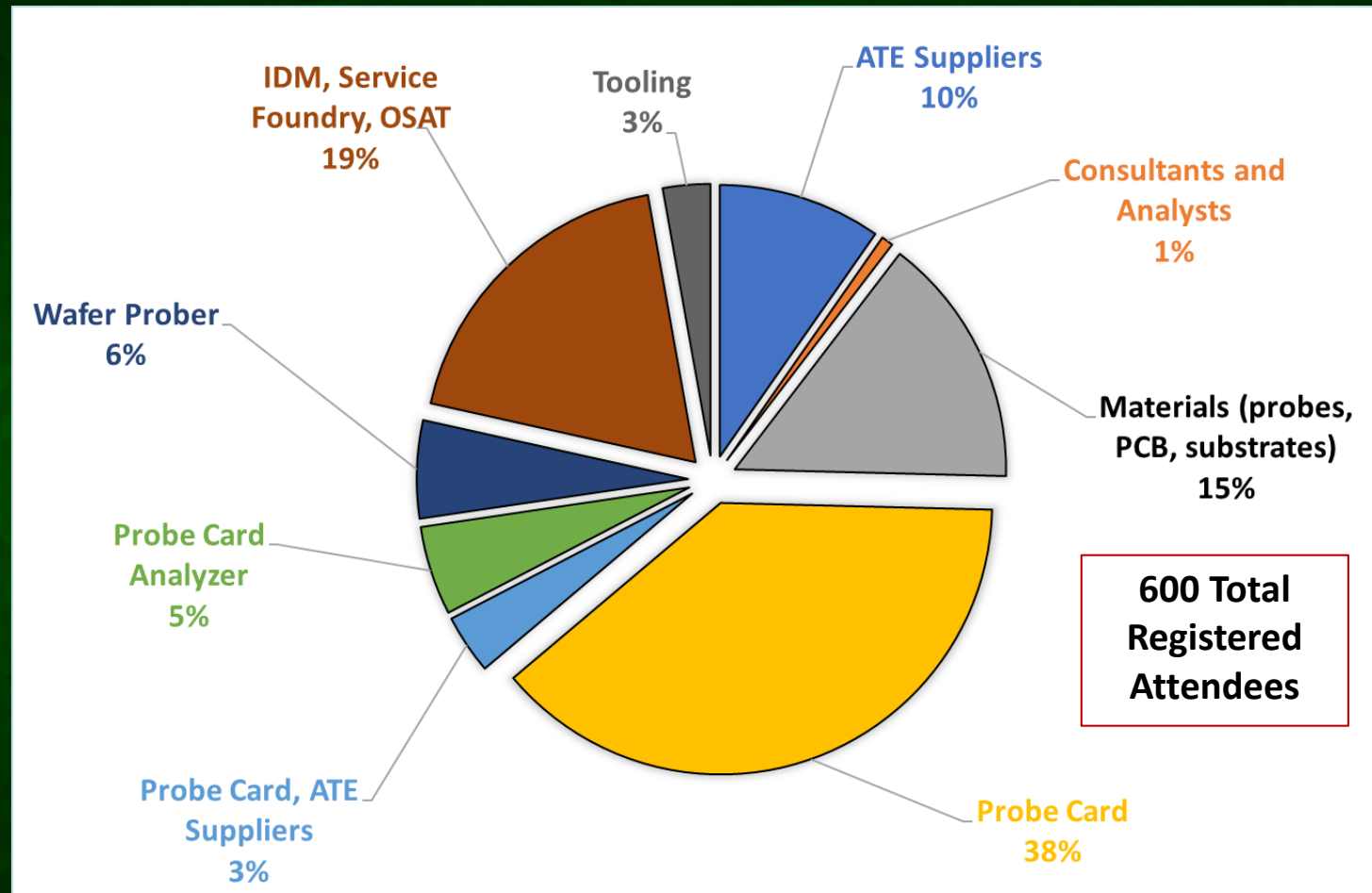


# SWTest 2019 Participation



**28 out of the 48 Presentations have at least one international author !**

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# SWTest 2019 eProceedings ?



Password for Sunday = monarch

Password for Monday = honeybee

Password for Tuesday =

Password for Wednesday =

- SWTest follows green initiatives for reduced printing.
- Each day of the conference will be available in an e-Version for download in a password protected file.
  - Go to ... <http://www.swtest.org>
  - Ballroom WiFi Password = santiago2019
- Free WiFi access will be available during the entire conference to allow attendee access to the downloads.
- Daily passwords to the download files will be announced throughout each day, respectively.
- Non-password locked files will be made available in the SWTest Archives after the conference adjourns.

# SWTest Conference Mobile App



- Up-to-the-minute “Event Info”
- Schedules of the “Sessions”
- Meet the “Session Chairs and Presenters”
- Network with the “Attendees”
- Get important updates with “SWTest News”
- Connect with the “Sponsors” and “Exhibitors”
- Attend the “Social Events”
- Get oriented on the “Map”
- Find treasure during the “Scavenger Hunt”
- Learn about “SWTest Asia 2019”



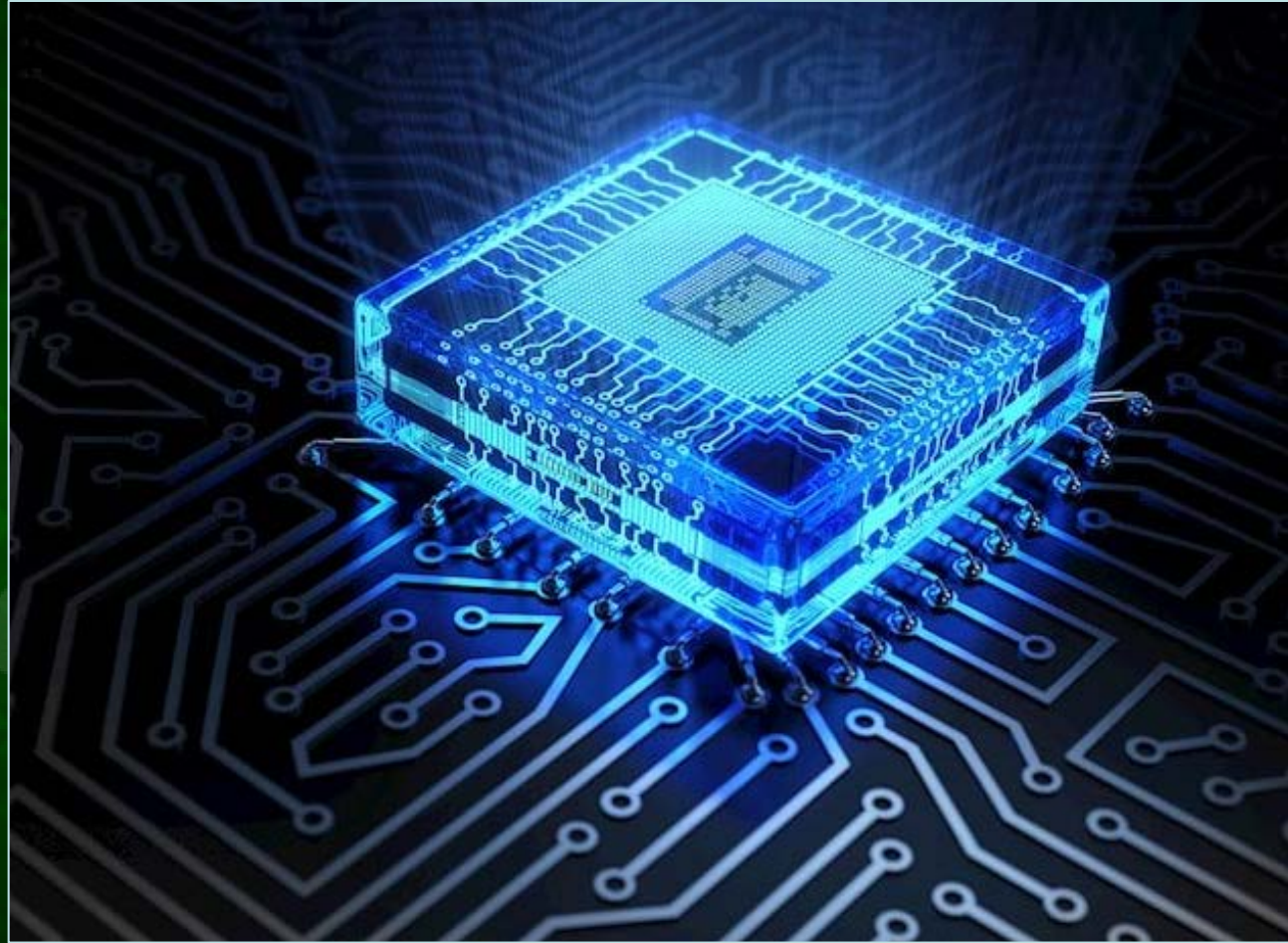
# Internet Phishing for SWTest Mailing List ?



- ALL attendee information provided to SWTest and SWTest Asia is safe and confidential.
- SWTest mailing lists are not available to anyone ...

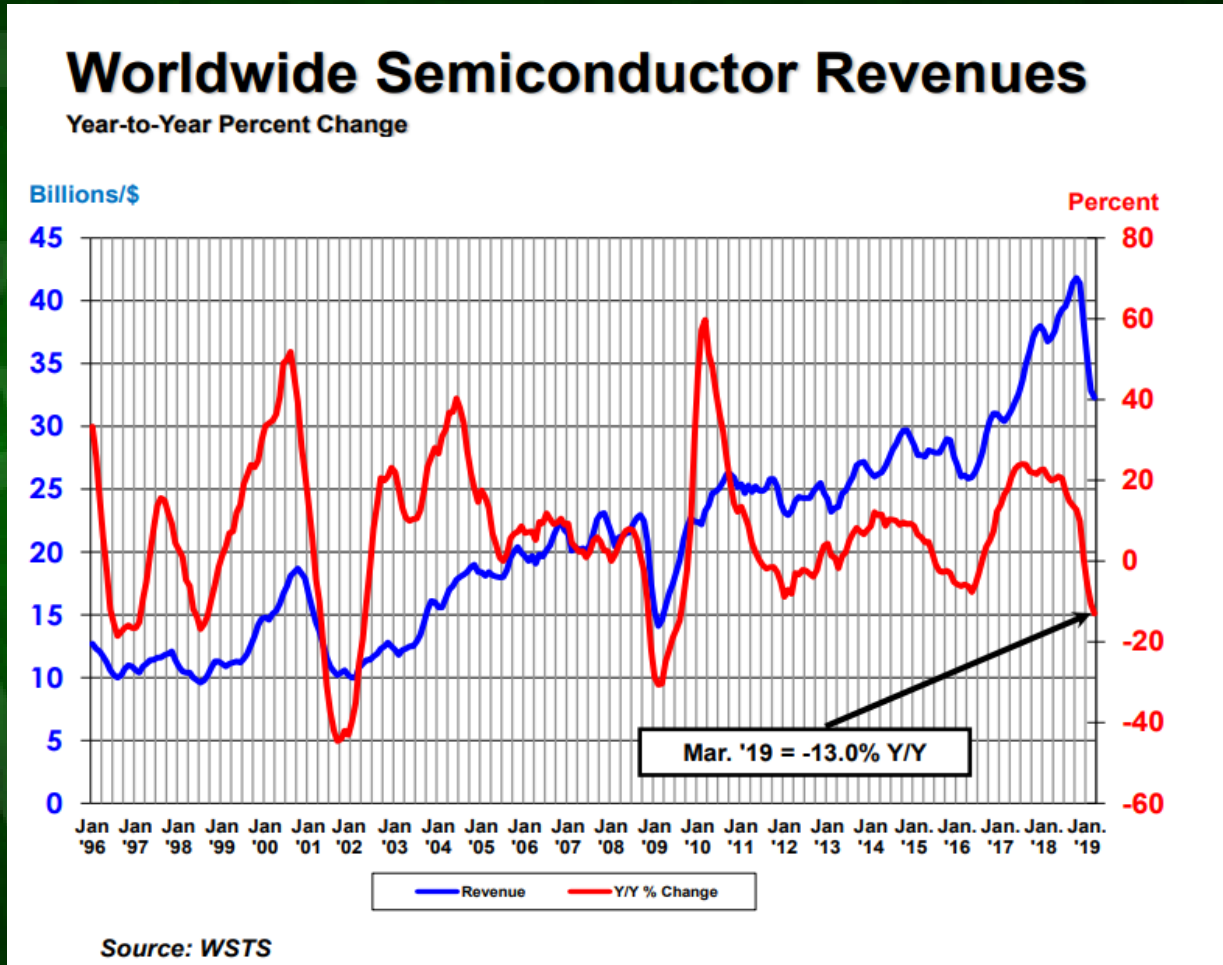
Never has and never will

# Ever Changing Semiconductor Landscape



# 2019 Semiconductor Market Expectations

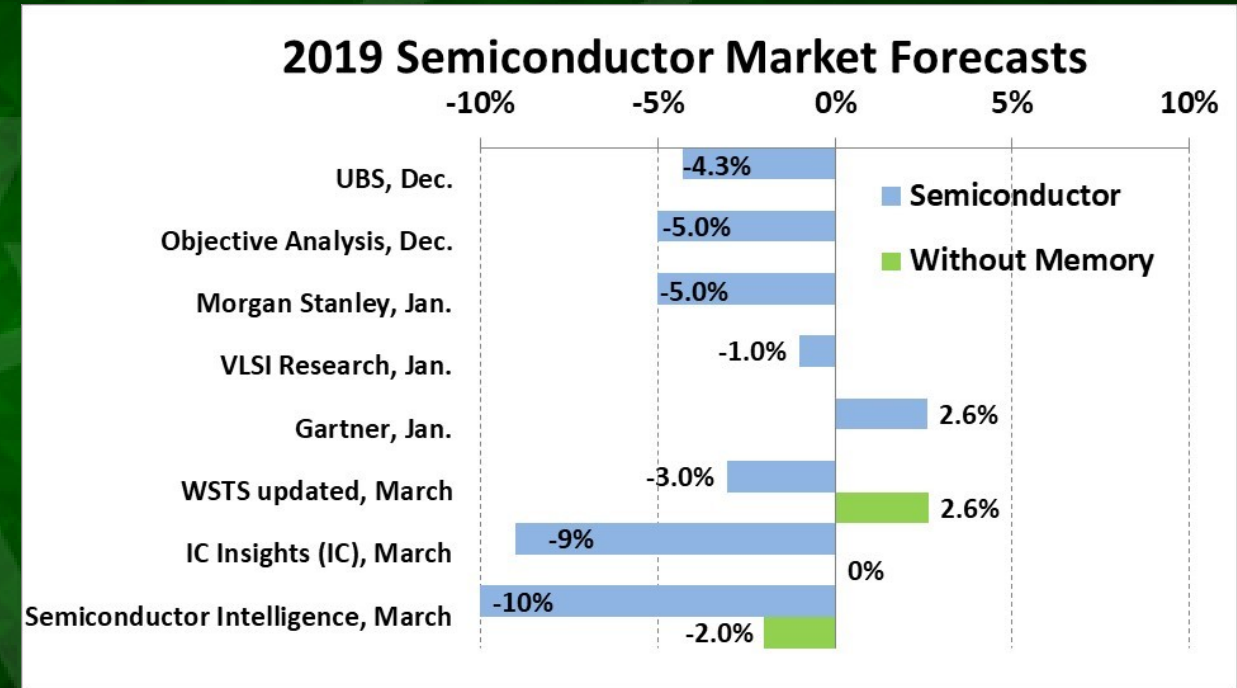
- In 2018, the Worldwide Semi-Market was up 13.7% to US\$468.8 billion (an all-time high).
- **BUT, In 2019, the Worldwide Market is forecasted to be down at least 3.0% to US\$454.5 billion.**
  - SIA announced sales of semiconductors totaled \$96.8 billion during the first quarter of 2019
  - 15.5% decrease over the previous quarter
  - 13% less than the first quarter of 2018
- **Modest growth is expected to return in 2020.**
- **Memory is expected to drop by 14.2%, BUT all other products are forecasted to grow low single digit compared to 2018.**





# 2019 Semiconductor Market Expectations

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# Intel Regained Number 1 Slot !

**1Q19 Top 25 Semiconductor Sales Leaders (\$M, Including Foundries)**

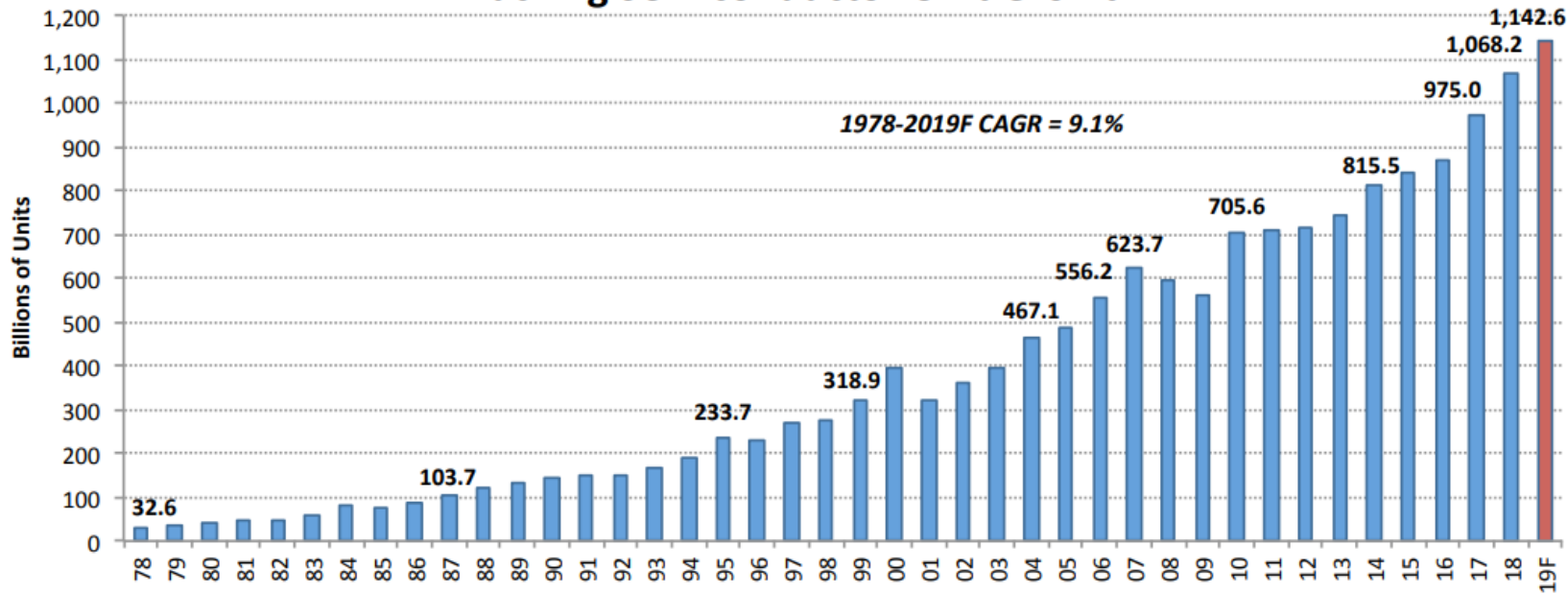
1Q19 Rank	1Q18 Rank	Company	Headquarters	1Q18 Total IC	1Q18 Total O-S-D	1Q18 Tot Semi	1Q19 Total IC	1Q19 Total O-S-D	1Q19 Total Semi	1Q19/1Q18 % Change
1	2	Intel	U.S.	15,832	0	15,832	15,799	0	15,799	0%
2	1	Samsung	South Korea	18,491	910	19,401	11,992	875	12,867	-34%
3	3	TSMC (1)	Taiwan	8,473	0	8,473	7,096	0	7,096	-16%
4	4	SK Hynix	South Korea	7,996	145	8,141	5,903	120	6,023	-26%
5	5	Micron	U.S.	7,486	0	7,486	5,475	0	5,475	-27%
6	6	Broadcom Inc. (2)	U.S.	4,125	434	4,559	3,940	435	4,375	-4%
7	7	Qualcomm (2)	U.S.	3,897	0	3,897	3,722	0	3,722	-4%
8	9	TI	U.S.	3,339	227	3,566	3,199	208	3,407	-4%
9	8	Toshiba/Toshiba Memory	Japan	3,517	310	3,827	2,355	295	2,650	-31%
10	12	Infineon	Europe	1,360	907	2,267	1,352	901	2,253	-1%
11	10	Nvidia (2)	U.S.	3,108	0	3,108	2,220	0	2,220	-29%
12	11	NXP	Europe	2,033	236	2,269	1,885	209	2,094	-8%
13	13	ST	Europe	1,696	518	2,214	1,581	485	2,066	-7%
14	25	HiSilicon (2)	China	1,245	0	1,245	1,755	0	1,755	41%
15	19	Sony	Japan	200	1,335	1,535	192	1,554	1,746	14%
—	—	<b>Top-15 Total</b>		<b>82,798</b>	<b>5,022</b>	<b>87,820</b>	<b>68,466</b>	<b>5,082</b>	<b>73,548</b>	<b>-16%</b>

(1) Foundry (2) Fabless

Source: Company reports, IC Insights' *Strategic Reviews* database

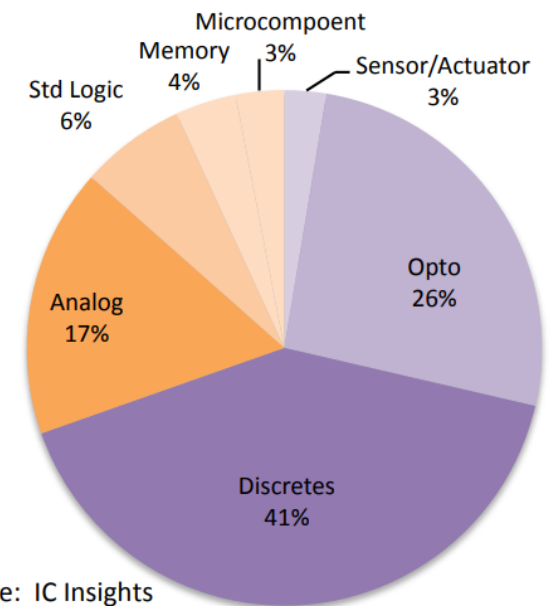
# Trillion Semiconductor Units Forecast for 2019 !

## Tracking Semiconductor Unit Growth



Source: IC Insights

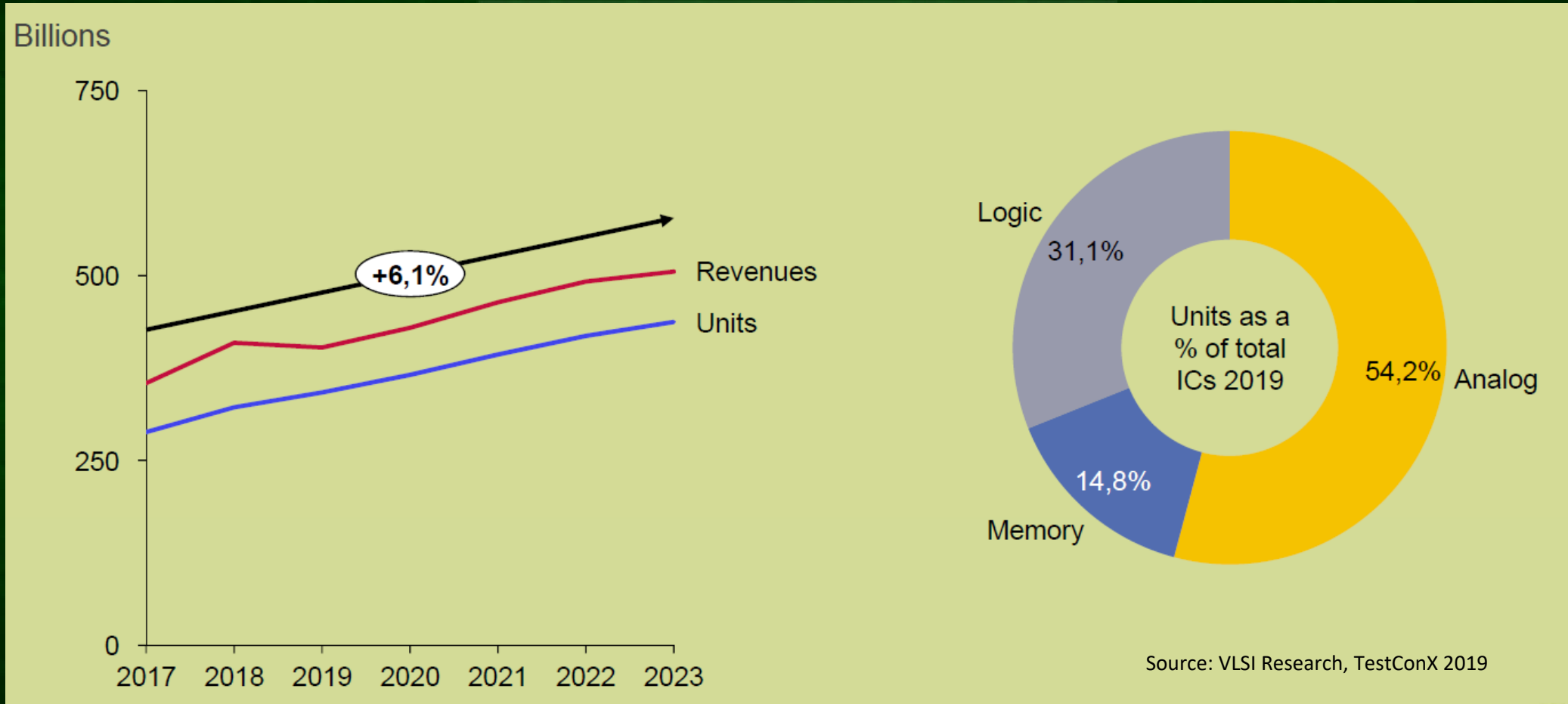
## 2019F Semiconductor Unit Shipments (1,142.6B)



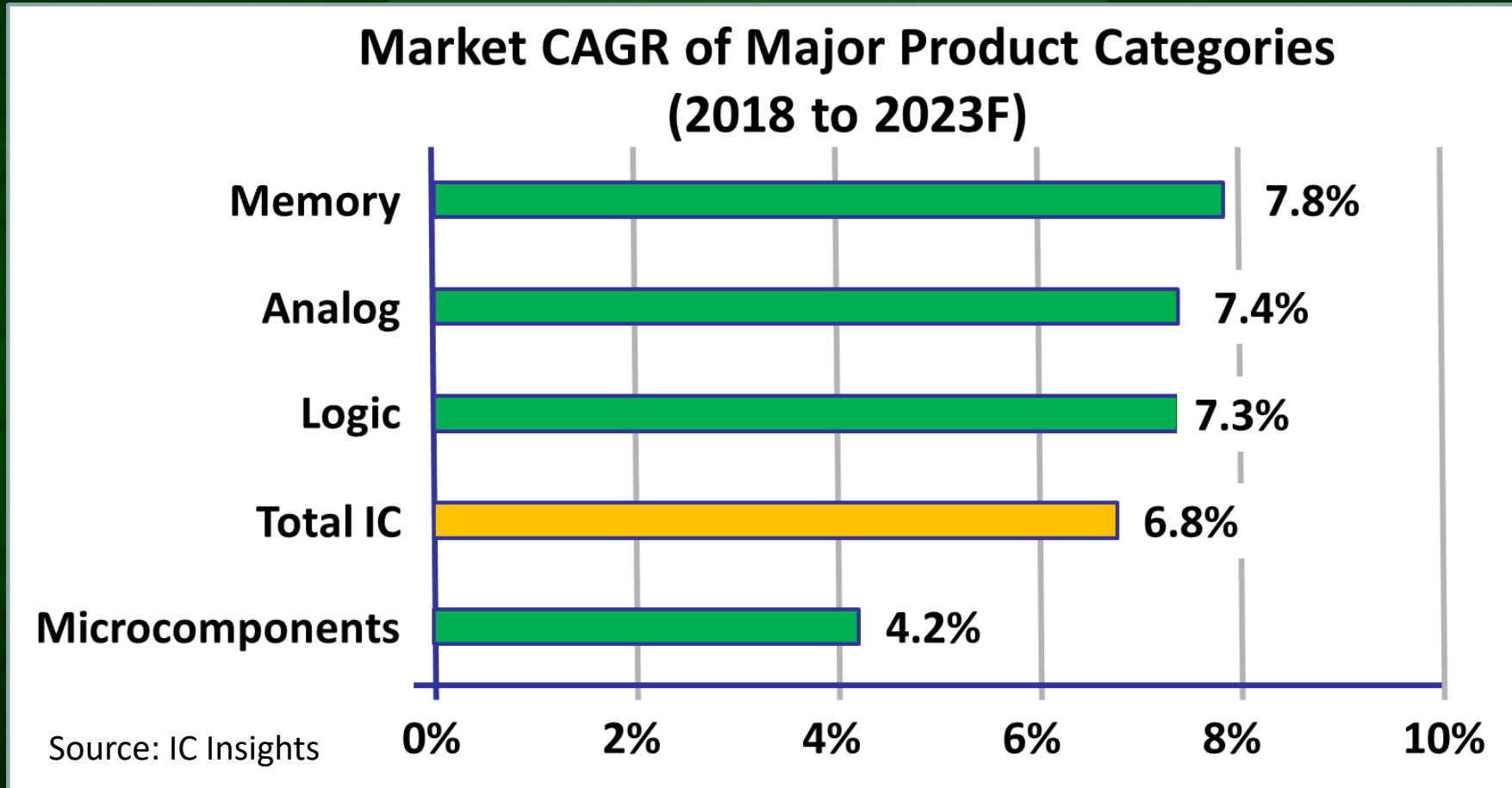
Source: IC Insights



# Number of Units Maintain Steady Growth



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# Where are these Billions of Units Going ?

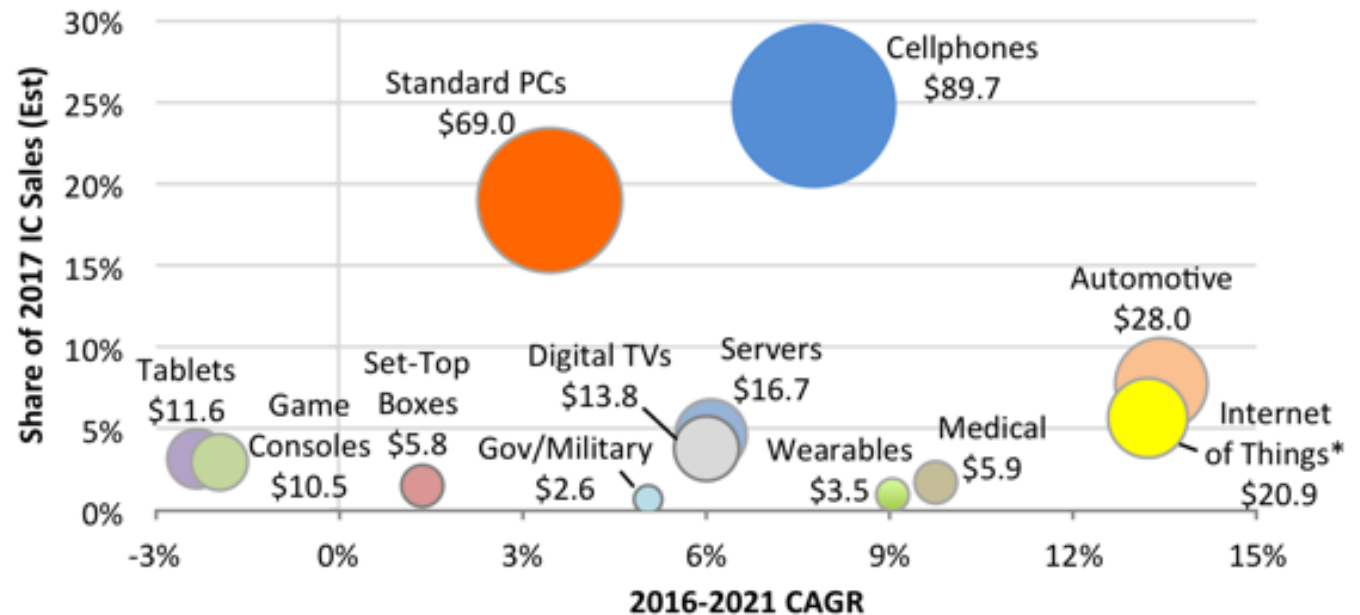
## 2018: Traditional Markets Slow Growth or Declining



## 2018: Markets with Higher Growth Potential



## IC End-Use Markets (\$B) and Growth Rates

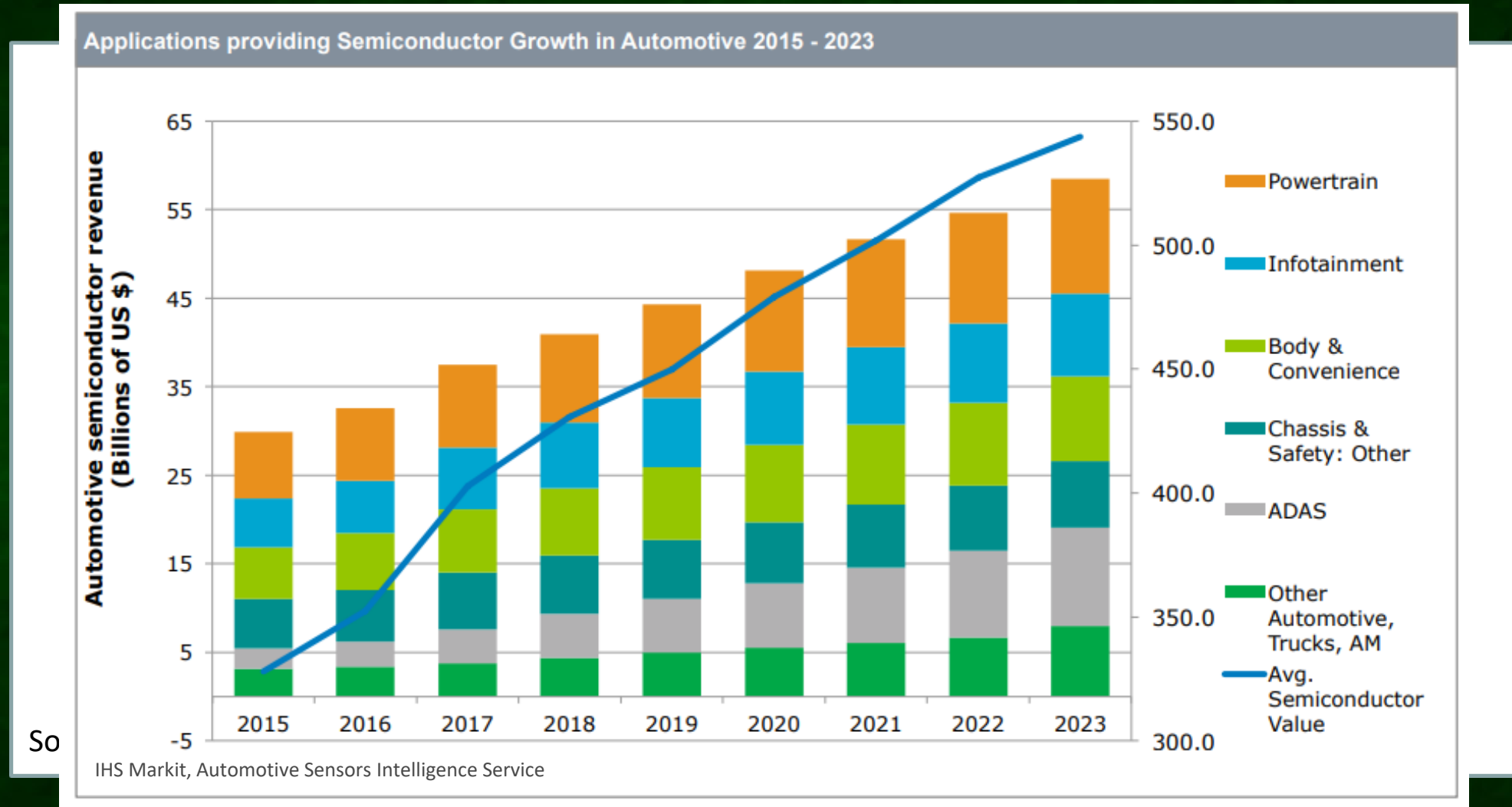


\*Covers only the Internet connection portion of systems.

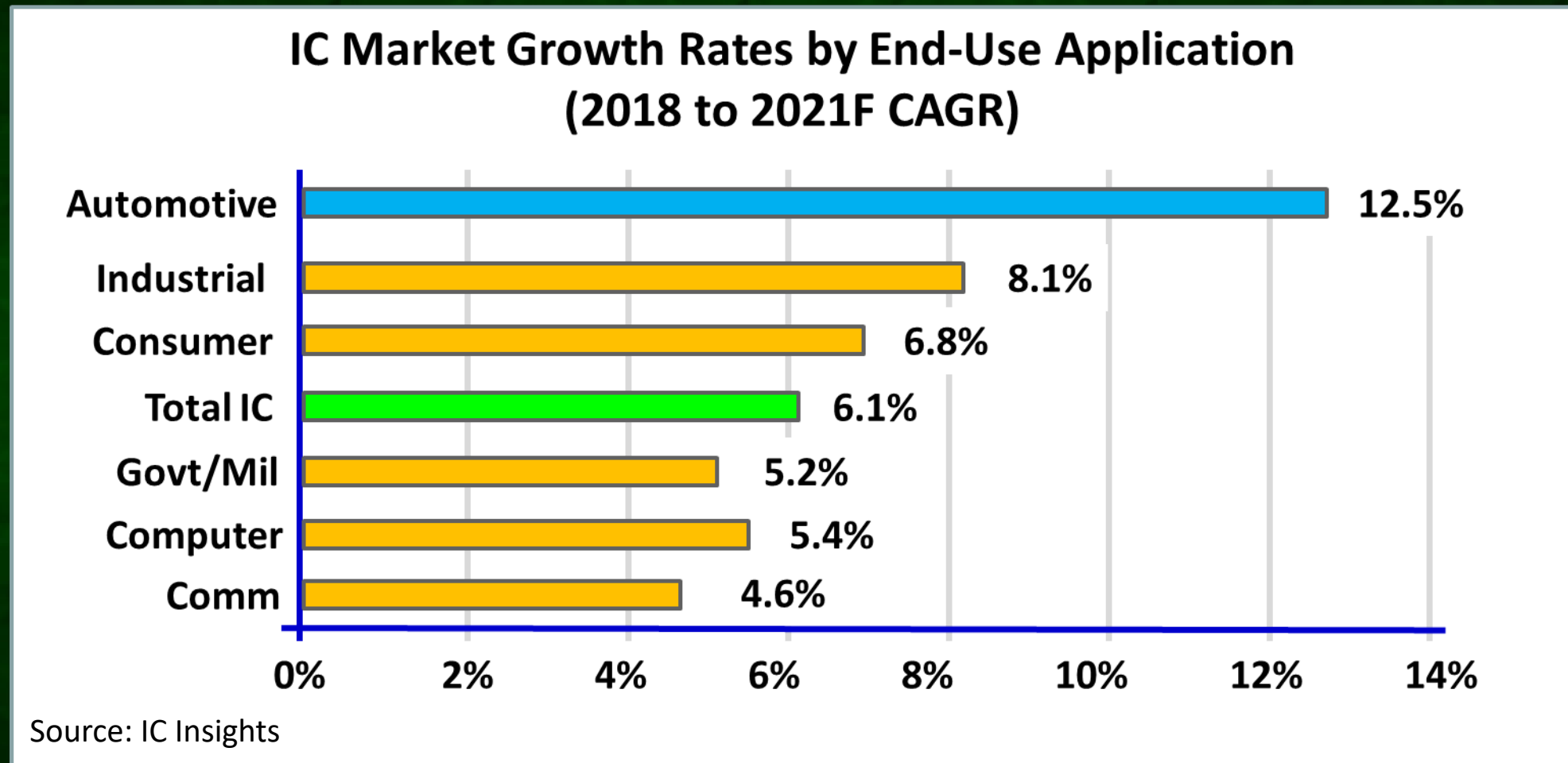
Source: IC Insights



# Automotive Applications are a Major “Driver”

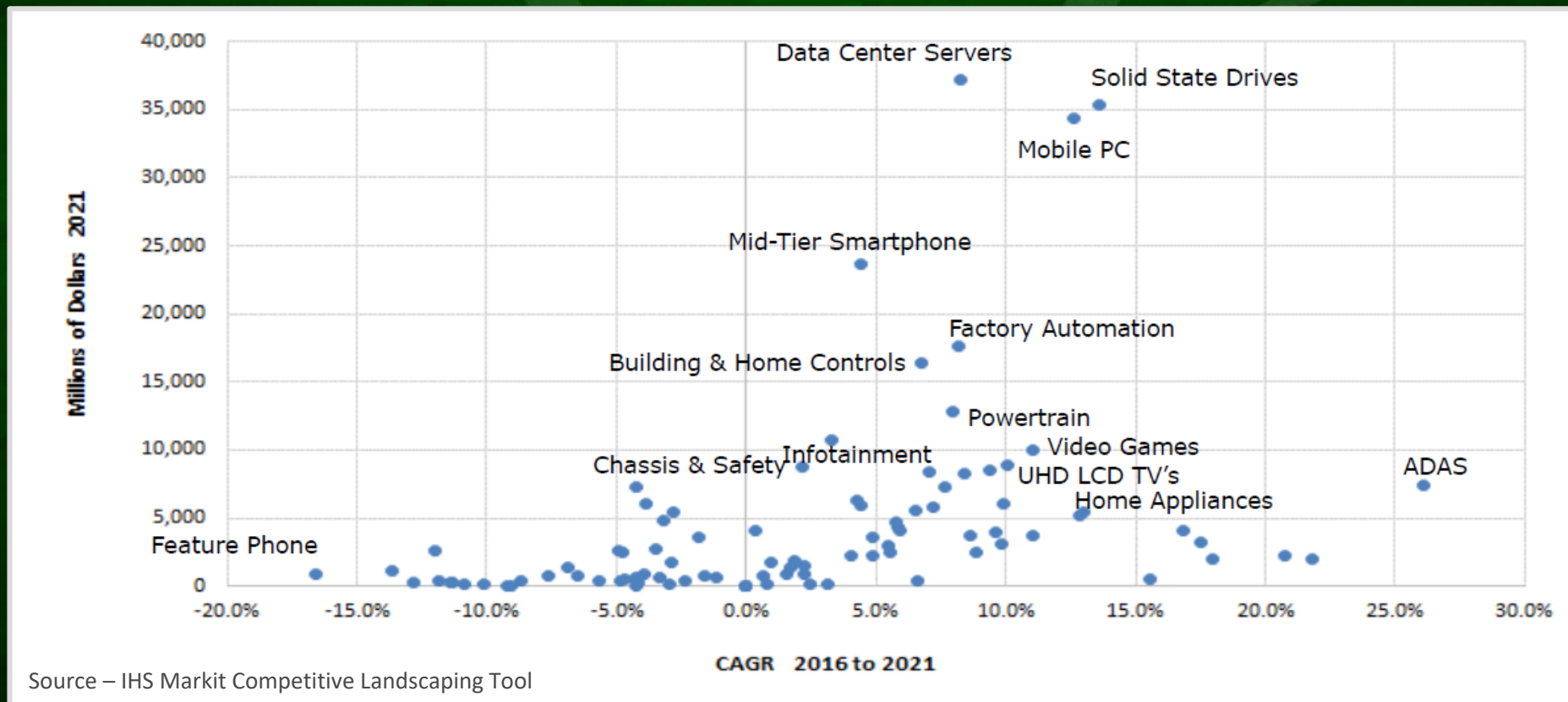


# Automotive Applications are a Major “Driver”



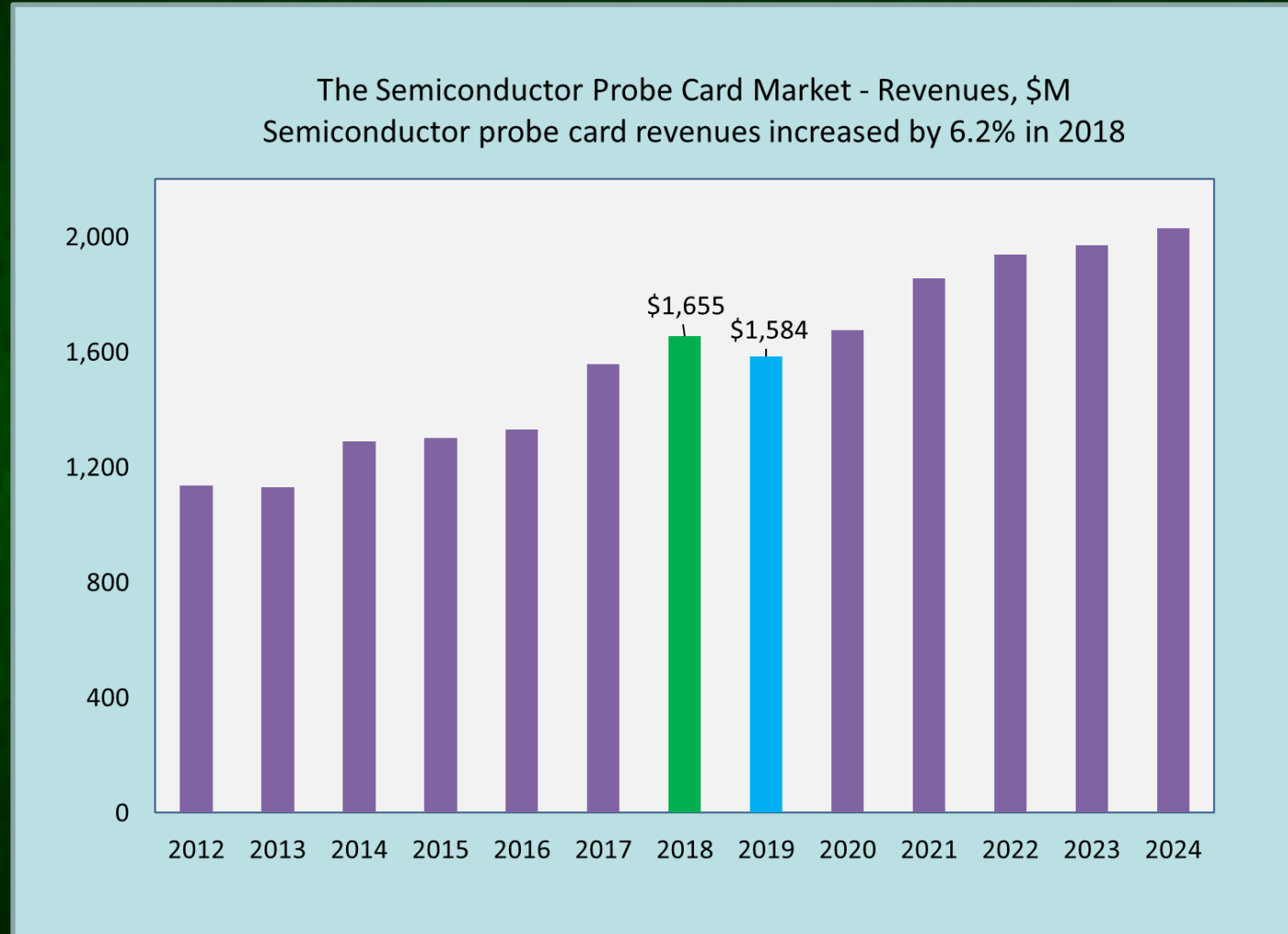
# “New Age” of Application Diversity

- More than ever Semiconductor manufacturers must develop and support a wider array of technologies optimized for specific applications

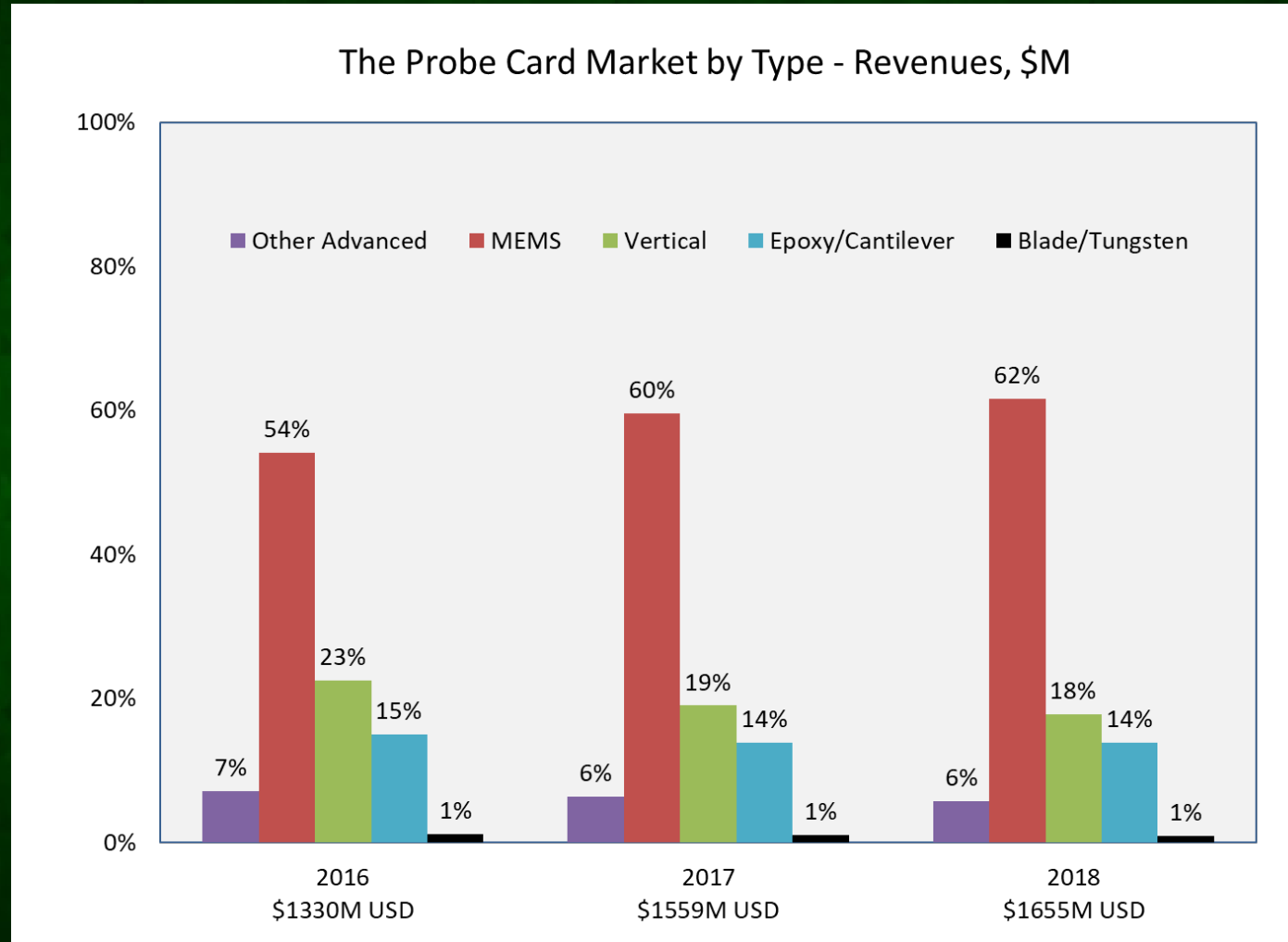




# Probe Card Market Landscape



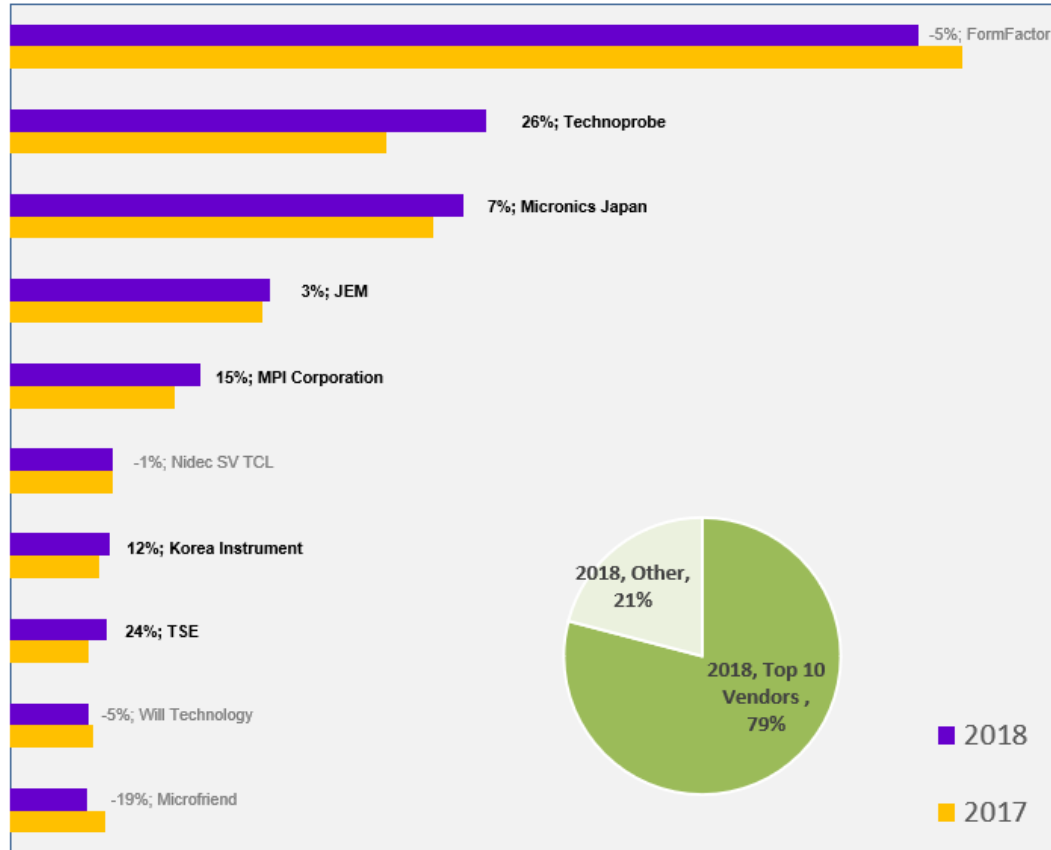
# Probe Card Technology Trending



# Top Probe Card Vendors of 2018

Top 10 Probe Card Vendors 2018, \$M

Technoprobe became the second largest supplier in 2018



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Rank	Company	2017	2018	Change (%)
1	FormFactor	454.79	434.27	-5%
2	Technoprobe	179.88	227.10	26%
3	Micronics Japan	201.80	216.51	7%
4	JEM	120.13	123.99	3%
5	MPI Corporation	78.60	90.69	15%
6	Nidec SV TCL	49.10	48.80	-1%
7	Korea Instrument	42.41	47.39	12%
8	TSE	37.01	45.82	24%
9	Will Technology	39.80	37.64	-5%
10	Microfriend	45.42	36.77	-19%
	Other	308.07	346.27	12%
Semiconductor Probe Cards		1557.01	1655.25	6.3%
Annual Growth			6.3%	



# 29th Annual SWTest Conference

- **Technical Program for 2019**

- Technical Tutorial on Sunday
- Nine Podium Sessions and Two Poster Sessions across Three Days
- 32 Podium and 9 Poster Presentations

- **Products / Services EXPO**

- 64 full size booths ... SOLD OUT !
- EXPO does not compete with Technical Program

- **Corporate Sponsors Program ... MANY THANKS !**

# Sunday Keynote Speaker

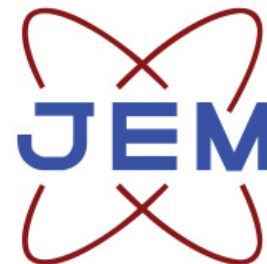
## Automotive, the Roadmap of Technologies and their Influences on Testing

**Davide Appello**

**Director of Product Engineering  
Automotive Digital Products Division  
STMicroelectronics (Agrate Brianza, Italy)**



# Platinum Sponsors





# Gold Sponsors



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# Silver Sponsors



SWTest | June 2-5, 2019

# SWTest Organization

- **SWTest Executive Team ...**

- Jerry Broz, Ph.D., General Chair and Sr. Member IEEE
- Rey Rincon, Technical Program Chair
- Maddie Harwood, Finance Chair & Conference Mgmt.

SWTest is organized, coordinated, and executed through the efforts of your colleagues.

- **Technical Program Committee**

- John Caldwell, Micron Technology
- Darren James, Rudolph Technologies
- Clark Liu, Powertech Technology, Inc. (Taiwan)
- Patrick Mui, JEM America
- Mark Ojeda, Cypress Semiconductor
- Raffaele Vallauri, Technoprobe (Italy)
- Joey Wu, Member-At-Large (Taiwan)

- **Steering Committee**

- Karen Armendariz, Celadon Systems
- Gunther Boehm, FeinMetall GmbH (Germany)
- Geert Gouwy, Melexis Semiconductor (Belgium)
- Michael Huebner, Ph.D., FormFactor
- Amy Leong, FormFactor, Inc.
- Suz Ramsbottom, Texas Instruments, Inc.
- Alex Yang, MPI Corporation (Taiwan)
- Sang Kyu (SK) Yoo, Samsung Electronics (Korea)



# Technical Program / Agenda

- **Monday, June 3**

- Technical Program with 4-podium sessions and 1-poster session
- SWTest EXPO 2019 w/ Dinner served that the Reception Stations

- **Tuesday, June 4**

- Technical Program with 3-podium sessions and 1-poster session
- SWTest EXPO 2019
- Tuesday night social and entertainment

- **Wednesday, June 5**

- Technical Program with 2-podium sessions

# SWTest 2019 Expo



- **64 Exhibits**
  - 42 in EXPO Tent
  - 22 in EXPO Ballroom
  - Food and Beverages in both locations
- **3 golf cart shuttles will make the rounds between locations.**
- **Win some prizes with the Scavenger Hunt.**

# Tuesday Evening Dinner and Social

**6:00 to 7:00 PM – Cocktails and Networking on the Patio and Lawn**

**7:00 to 9:00 PM – Dinner, followed by Casino Royale Gambling & Screen Golf Challenge**





# Recognition & Awards

- **Best Overall Presentation**
- **Best Data Presentation**
- **Most “Inspirational” Presentation**
- **Best Presentation, Tutorial in Nature**
- **Best Poster Presentation**
- **A presentation from SWTest 2019 will be selected for the TEST VISION Symposium**
  - Program on July 10 to 19, 2019
  - SWTest will award a travel grant to support participation





# SWTest 2018 Awards

## Most Inspirational Presentation

Carbon Nanotube Based Microprobe Design for  
Electromechanical Probing Applications at Wafer Level Chip  
Scale and Wafer Level Packaging

Mehmet Tas, et. al. (University of Surrey – UK)  
*Bill Mann Student Award Recipient*



## Best Presentation, Tutorial in Nature

A Novel Measurement Method for Measuring  
CCC and MAC at Once

Dr. Matthias Schnaithmann, et. al, (FEINMETALL – Germany)



# SWTest 2018 Awards

## Best Data Presentation (tie)

Probing solutions and inherent customization to enable advanced copper-based 3D integration schemes

Dr. Emanuele Bertarelli, et. al. (Technoprobe – Italy)

*As presented by Raffaele Vallauri*



## A Real Life Pad Crack Study

Gunther Boehm , et. al (FEINMETALL -Germany)

Jory Twitchell (NXP, USA)



# SWTest 2018 Awards

## Best Overall Presentation (tie)

Device interface complexity challenges of the next decade

Steve Ledford (Teradyne – USA)



Micro burn-in techniques at wafer-level test to implement cost effective solutions

Geert Gouwy (Melexis – Belgium)

Dr. Alessandro Antonioli, et al. (Technoprobe – Italy)





# SWTest 2018 Awards

## Best Poster Presentation

Tri-Temperature Probing: -55C to >125C

Chris Buckholtz and Roger Sinsheimer (Teradyne - USA)





# William R. Mann Student Travel Grant



**Bill Mann**  
Founder of SWTest  
Chair Emeritus

- Partially funded by the SWTest annual Golf Tournament's "Beat the Pro" hole contest and several hundred dollars each year.
- "William R. Mann Student Travel Grant" is being awarded to one recipient in 2019.
  - Peter Chiu, a B.Sc. Computer Engineering student University of Illinois at Urbana Champaign (UIUC).
- SWTest Conference provides a stipend of up to \$1,000 to cover expenses for travel, hotel accommodations, and student registration.

# That “Special” Award ...



## Bill Mann's Poorest Disguised Sales Pitch

*“What happens at SWTest  
stays at SWTest !!”*

# SWTest Asia 2019 on October 17 to 18, 2019



<http://www.SWTestAsia.org>



Sheraton Hsinchu Hotel, Zhubei City, Taiwan

- **Two Day Technical Conference and Expo**

- Two Day Technical Program with 4-Technical Sessions
  - Accepting abstract submission for Podium Presentations.
- 40 Booth EXPO of key suppliers for probe and wafer test
- Technology Showcase from Key Suppliers
  - Focused Presentations made by Platinum Sponsors
- Relaxed Networking in the “Spirit of SWTest San Diego”

- **SWTest Asia Technical Committee**

- Jerry Broz, Ph.D., SWTest Asia General Chair
- Clark Liu (PTI Taiwan), SWTest Asia Technical Program Chair
- Rey Rincon, SWTest Asia Technical Program Co-Chair
- Nobuhiro Kawamata (Formfactor, K.K.)
- Alan Ferguson, Ph.D. (Oxford Lasers, Inc.)
- Joey Wu (Member-At-Large)



# Key Dates for SWTest Asia 2019

- **Friday, August 16, 2019 – Abstract Submission Deadline**
- **Friday, August 23, 2019 – Notification of Acceptance**
- **Tuesday, October 8, 2019 – Final Paper Submission Deadline**
- **Thursday, October 17, 2019 – Conference Start Date**
- **Friday, October 18, 2019 – Conference End Date**



<http://www.SWTestAsia.org>



# 1<sup>st</sup> Annual SWTest Asia Golf Tournament

- The Royal Kuan-Hsi Golf Club, Hsinchu, Taiwan



# Conference Partner Spotlight

- **IS Test Workshop**



- **Torsten Liese, General Chair**

- **Program Committee**

- Harald Berger (Robert BOSCH, Germany)
- Ari Kuukkala (AFORE, Finland)
- Dr. Rainer Gaggl (T.I.P.S. Messtechnik, Austria)
- Reza Haddad (INFINEON, Austria)
- Krzysztof Dabrowiecki (FEINMETALL, Germany)
- Marcus Verhoeven (Aspect Systems, Germany)
- Gabriel Tak (SEMICS, Korea)
- Jason Kim (SEMICS, Korea)

- **TestConX**



- **Ira Feldman, General Chair**

- **Program Committee**

- Ashok Kabadi (AK Technology (AKT) Leadership)
- Ila Pal (Ironwood Electronics)
- Ayman Abdo (Intel)
- Valts Treibergs (Cohu)
- Tom Bresnan (R&D Altanova)
- Hongjun Yao (Qualcomm)
- Marc Moessinger (Advantest)
- Frederick Taber (Taber Consulting)
- Krzysztof Dabrowiecki (FEINMETALL, Germany)
- Rahima Mohammed (Intel)
- James Tong (Texas Instruments)
- Jason Mroczkowski (Cohu)

# Want to Learn More ?

- **IEEE Holm Conference on Electrical Contacts**  
<http://www.ieee-holm.org>



- **IS-Test Conference**  
<http://www.is-test.com>



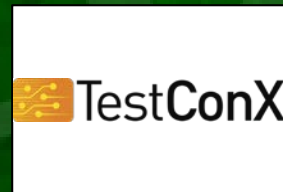
- **SEMI TESTVISION Symposium**



- **IEEE North Atlantic Test Conference**  
<http://www.is-test.com>



- **TestConX**  
*Formerly BiTS Burn In & Test Strategies*  
<http://www.bitsworkshop.org/>



- **Electronic Components and Technology Conference**  
<http://www.ectc.net>



- **VLSI Research**  
<https://www.vlsiresearch.com/>





# Come visit SWTest Asia ...



**2nd Annual SWTest Asia - 2019**  
Thursday and Friday, October 17-18, 2019  
Sheraton Hsinchu Hotel, Taiwan, R.O.C.

# See you Next Year in San Diego ...



**SWTEST**  
PROBE TODAY, FOR TOMORROW  
2020 Conference

30<sup>th</sup> Anniversary  
**May 31 – June 3, 2020**  
Rancho Bernardo Inn  
San Diego, California



**Thanks for Attending ...**  
**See you again ... May 31 to June 3, 2020 !!!**

Rancho Bernardo Inn, San Diego, CA



# Thanks for your Support !

- Contact the SWTest Team with any questions ...

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**Technical Program Chair**  
**SWTest Conference**  
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**Maddie Harwood**  
**Finance Chair/Conference Mgr.**  
**SWTest Conference and Expo**  
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