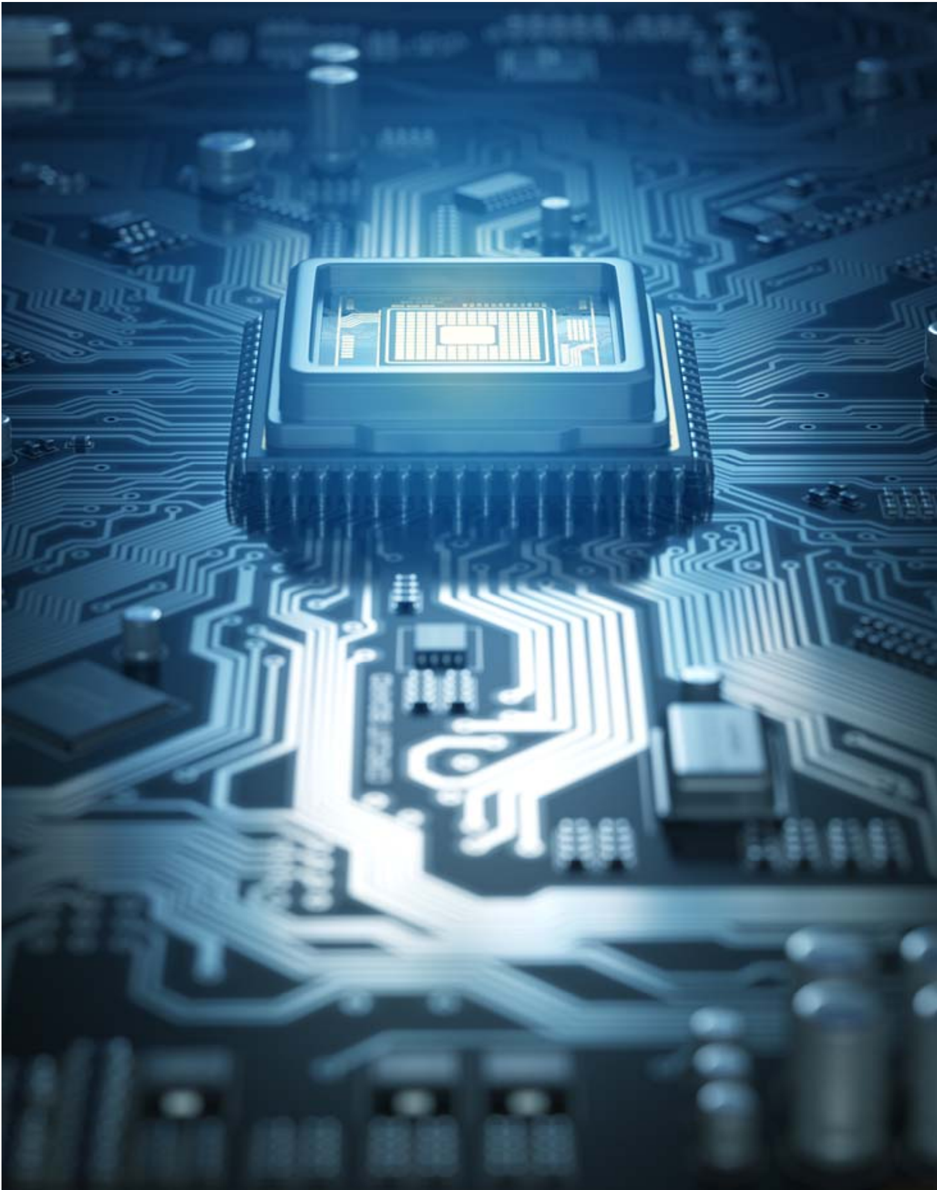


KLA and Advanced Packaging

Oreste Donzella, Executive Vice President

EPC Group

June 16, 2021

Forward-Looking Statements

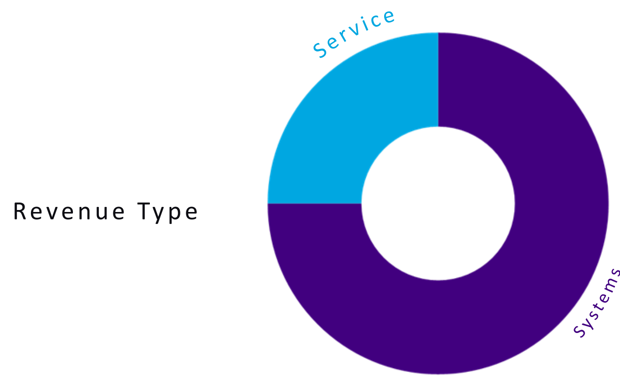
Statements in this presentation other than historical facts, such as statements pertaining to: (i) industry trends; (ii) customer demand and investment strategy; (iii) anticipated synergies from acquisitions; (iv) hiring by KLA; (v) anticipated dividends and share repurchases; (vi) WFE and KLA cyclicality; (vii) projected end-demand uses for semiconductors; (viii) growth of KLA's service business; (ix) sales, revenue growth rate, operating margin, EPS, capital allocation, semiconductor industry CAGR, capital intensity, memory and foundry/logic mix, process control market growth rate and growth in new markets through 2023; are forward-looking statements and subject to the Safe Harbor provisions created by the Private Securities Litigation Reform Act of 1995. These forward-looking statements are based on current information and expectations, and involve a number of risks and uncertainties. Actual results may differ materially from those projected in such statements due to various factors, including but not limited to: the future impacts of the COVID-19 pandemic; the demand for semiconductors; the financial condition of the global capital markets and the general macroeconomic environment; new and enhanced product and technology offerings by competitors; push-out of deliveries or cancellation of orders by customers; the ability of KLA's research and development teams to successfully innovate and develop technologies and products that are responsive to customer demands; KLA's ability to successfully manage its costs; market acceptance of KLA's existing and newly issued products; changing customer demands; and industry transitions. For other factors that may cause actual results to differ materially from those projected and anticipated in forward-looking statements in this letter, please refer to KLA Corporation's Annual Report on Form 10-K for the year ended June 30, 2020, and other subsequent filings with the Securities and Exchange Commission (including, but not limited to, the risk factors described therein). KLA Corporation assumes no obligation to, and does not currently intend to, update these forward-looking statements.

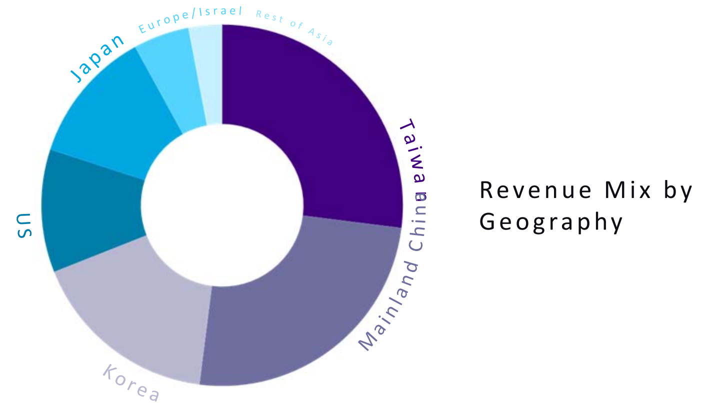
KLA

Global Leader in Electronics Ecosystem

2020: Another Outstanding Year for KLA

Revenue Type

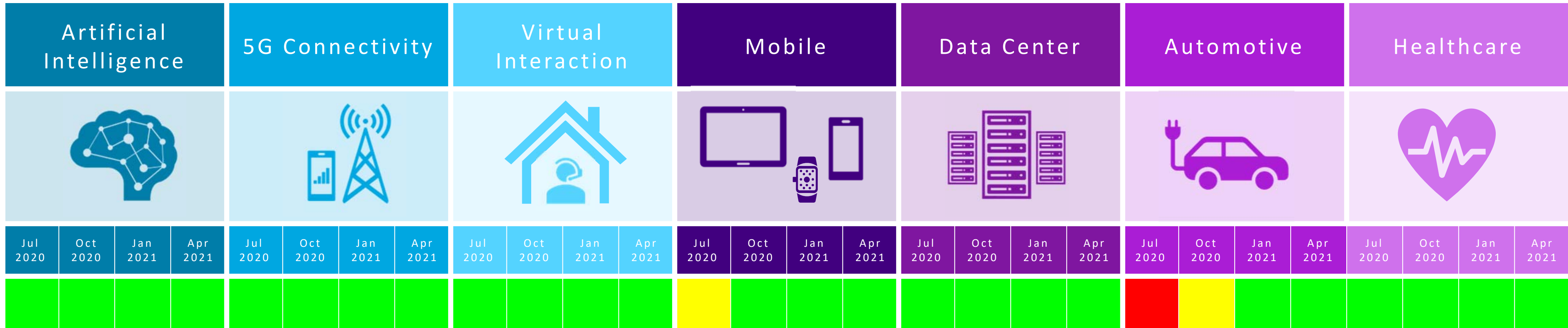


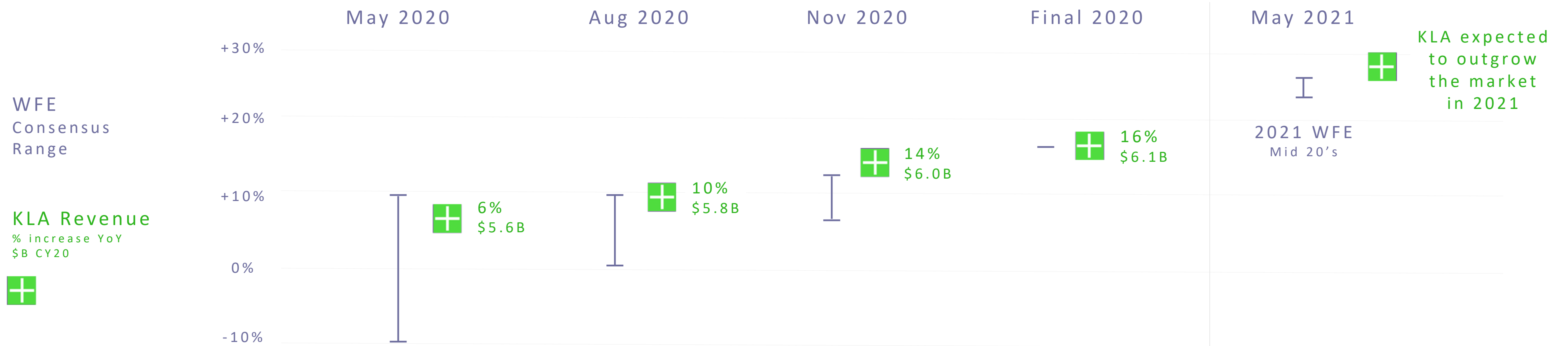


Revenue Mix by Geography

KLA

2021: The Secular Story Continues





KLA

Semiconductor Process Control

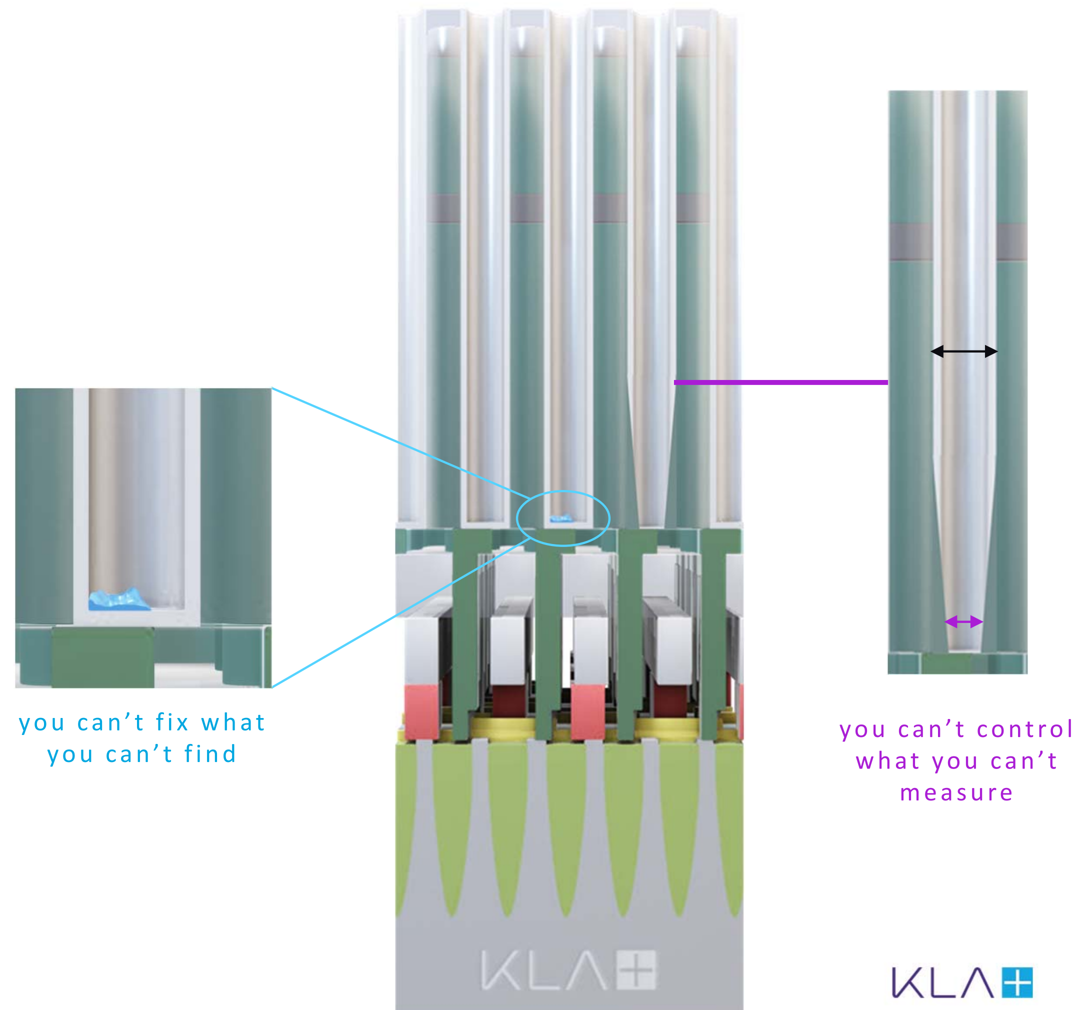
KLA systems find the

defects

and

variations that affect

chip performance



EPC

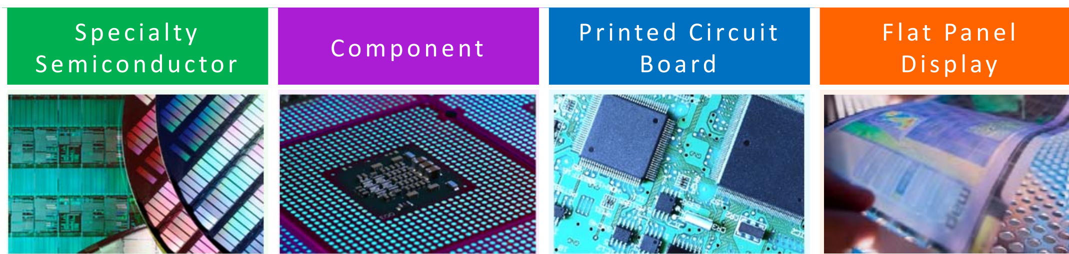
The "More than Moore" Organization

The Acquisition of Orbotech and SPTS

February 2019

KLA Completes Acquisition of Orbotech Ltd.

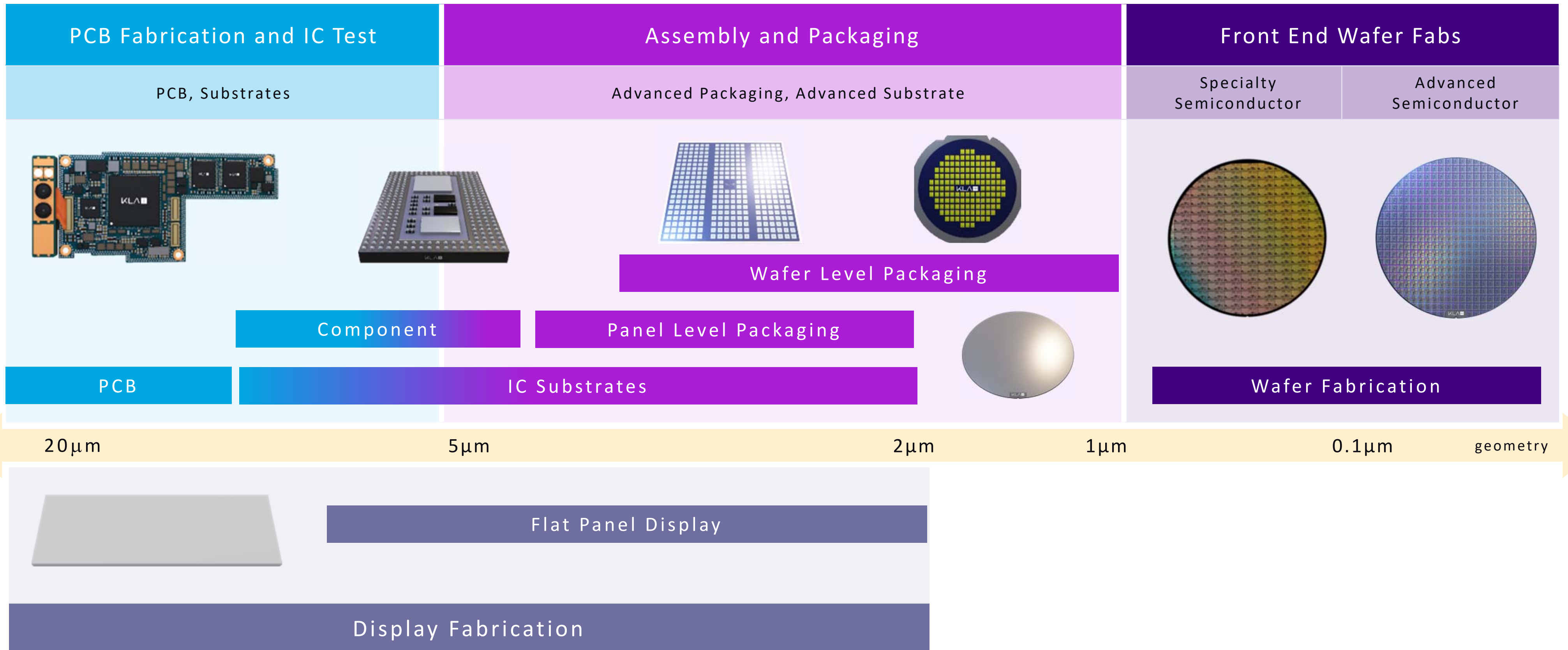
February 20, 2019 at 9:15 AM EST



- Extends reach within the electronics value chain
- Increases exposure to fast growing markets
- Complements geographic and customer footprints
- Provides differentiated product portfolio
- Supports long term revenue and earnings growth targets
- Installed base utilization creates predictable long term revenue stream

Market Expansion Across the Entire Electronics Ecosystem

February 2019



KLA

The Creation of EPC Group

February 2020

Rick Wallace
President and Chief Executive Officer

Ahmad Khan
President

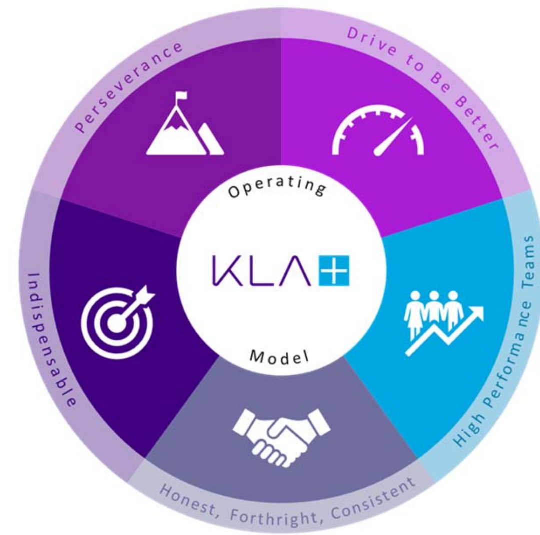
SEMI PC

Brian Lorig
Executive Vice President

GSS

Oreste Donzella
Executive Vice President

EPC



- Consistent strategy and execution
- Management by metrics
- Financial discipline and rigor

KLA

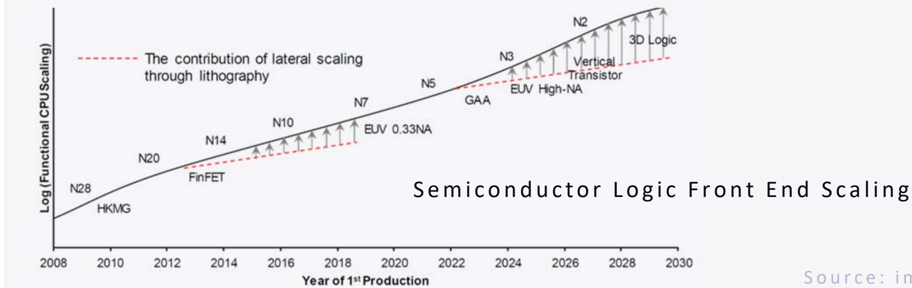
The "More than Moore" Organization

Moore's Law

Moore's Law
1965

"Cramming more components onto integrated circuits"

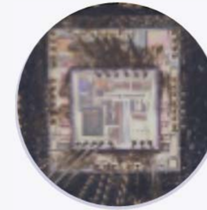
"Number of transistors is expected to double every 2 years"



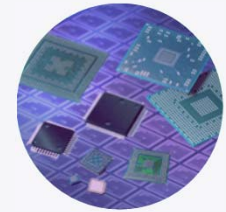
Semiconductor Logic Front End Scaling

Source: imec

More than Moore



Specialty Semiconductor



Packaging

PCB and IC Substrates

Display

SEMI PC GSS EPC

KLA

Large and Diversified Customer Base

WAFER HOUSES: SUBSTRATE MANUFACTURING

Tier 1 | Tier 2 | Start Ups | SiC

CHIP MANUFACTURING SPC

WAFER LEVEL PACKAGING SPC AND EPC

COMPONENT EPC

PRINTED CIRCUIT BOARD EPC

END PRODUCTS

WAFER HOUSES
(substrate manufacturing)

INTEGRATED CIRCUITS FABRICATION
(chip manufacturing)

WAFER LEVEL PACKAGING

COMPONENTS

PRINTED CIRCUIT BOARD

MASK SHOPS
(reticle manufacturing)

FLAT PANEL DISPLAY

KLA | PROCESS

MASK SHOPS: RETICLE MANUFACTURING

Merchant | Captive | Blanks

CHIP MANUFACTURING EPC

business units

- GLOBAL SERVICE SUPPORT (GSS)
- SEMI-PROCESS CONTROL (SPC)
- ELECTRONICS PACKAGING AND COMPONENTS (EPC)

FLAT PANEL DISPLAY EPC

AUTOMOTIVE
(OEMs (Bosch, Continental) and automakers (Ford, Tesla, etc.))

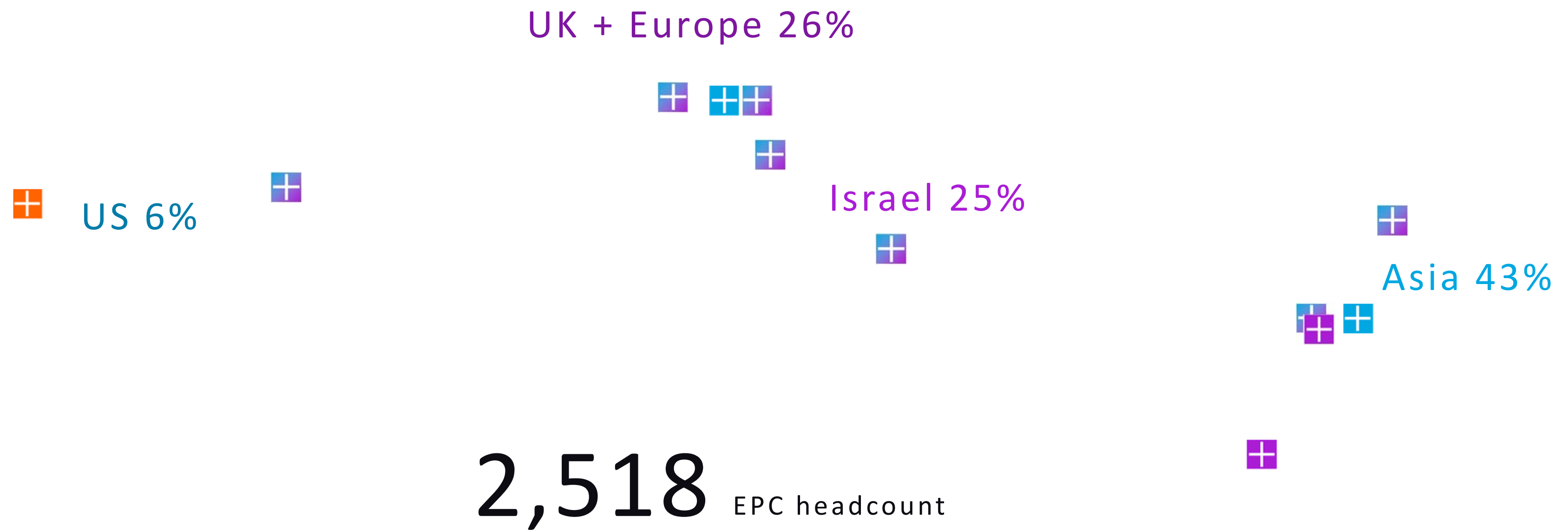
IoT, CONSUMER
(laptops, watches, smart speakers, VR/AR, security cameras, smart everything…)

MOBILE DEVICES
phones

5G INFRASTRUCTURE
(towers not phones)

DATA
(data servers (Dell), data centers/cloud (Facebook, Google, Microsoft))

Global Organization



2,518 EPC headcount

HQ R&D manufacturing R&D/manufacturing

KLA

Advanced Packaging

"Everything is Changing"

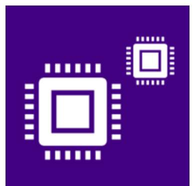
Semiconductor Technology has been Scaling for 50+ years

1980 | 1990 | 2000 | 2010 | 2020

g-line (436nm) | i-line (365nm) | KrF (248nm) | ArF (193nm) | ArF Immersion (193i)

EUV (13.5nm)

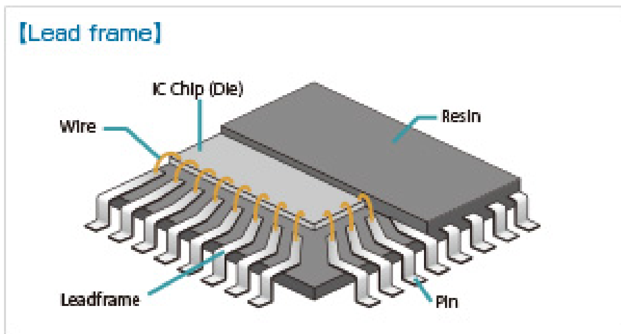
1µm
500nm
250nm
130nm
65nm
32nm
16nm
10nm
7nm
5nm
3nm

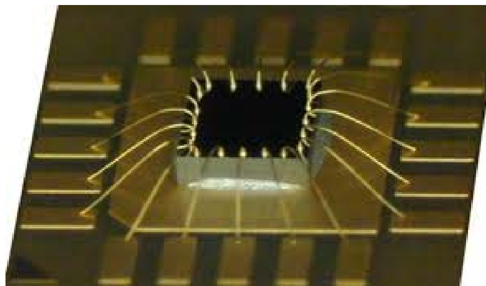


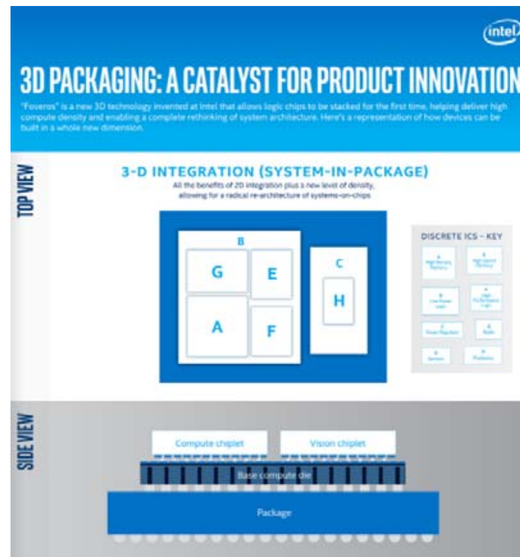
Conventional Transistor Scaling is still happening, but becoming expensive

KLA

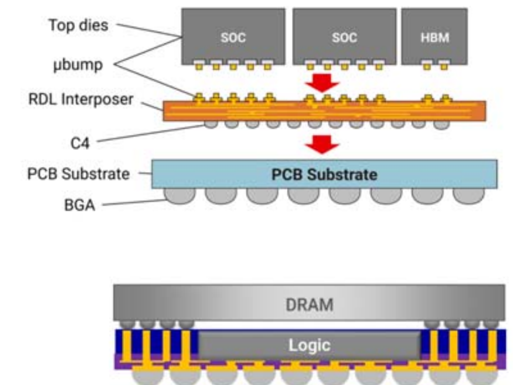
Advanced Packaging: Crucial to Semiconductor Technology Roadmap







Source: Intel



Source: tsmc

From IC Protection to Performance Differentiation

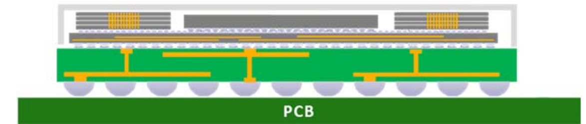
KLA

More Packaging Types | Higher Complexity

Time of Flight Sensor

InFO-oS

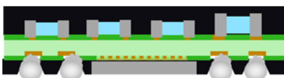
2.5D-3D



Antenna in Package (AIP)

CIS - Sensor

SiP -DSMBGA



Complex Shape SiP

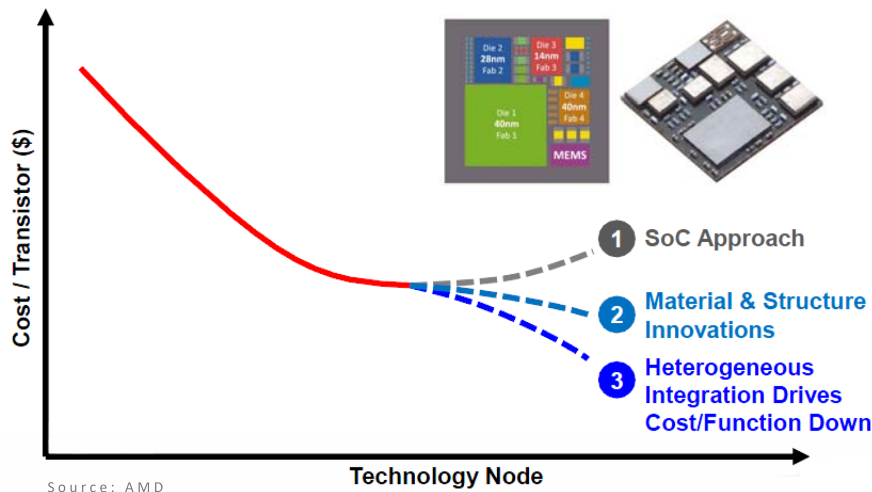
QFN – PMIC

2.5D - ADAS

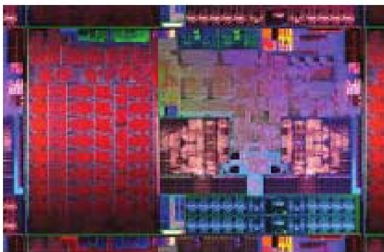
Significant Investment Plan to Overcome New Challenges

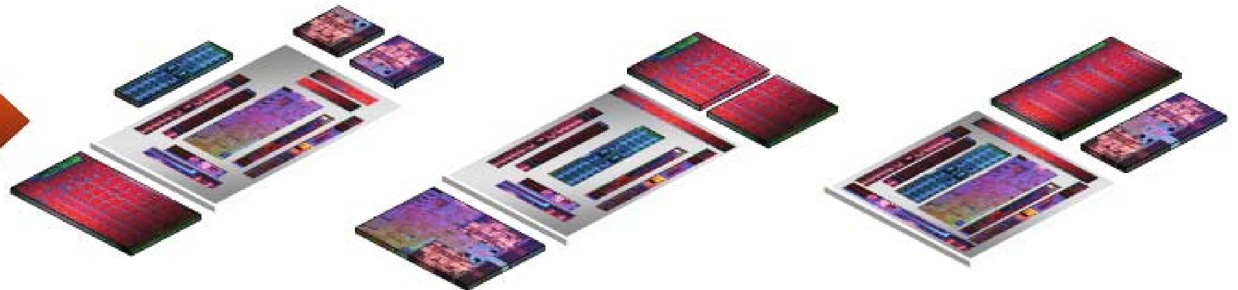
KLA

Heterogenous Integration: Scaling while Keeping Cost Down



- From System on Chip (SOC) to Chiplets
- High cost only for core functionalities
- Disaggregation of the non-core functionalities
- Heterogenous integration via packaging

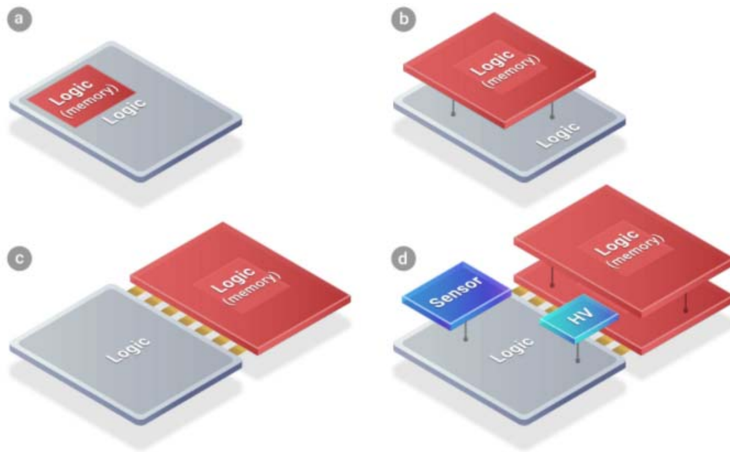




KLA

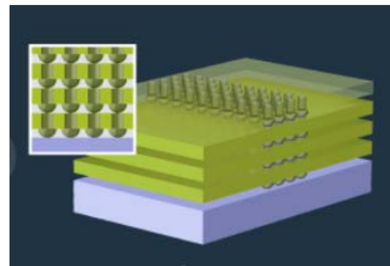
Hybrid Bonding: The Big Next Inflection in Heterogeneous Integration

Integration Schemes



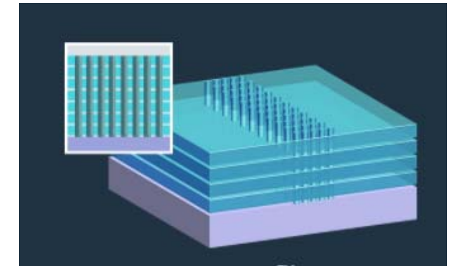
Source: tsmc

Thermo-Compression (Bump)



Source: tsmc

Hybrid (Bump-less)



Source: tsmc

- Key Benefits: Speed, Bandwidth and Power Efficiency through increased interconnect density
- Hybrid Bonding in Packaging with D2W integration key for AI Logic Chips and High Bandwidth Memory

Several Inspection, Metrology and Integration Challenges

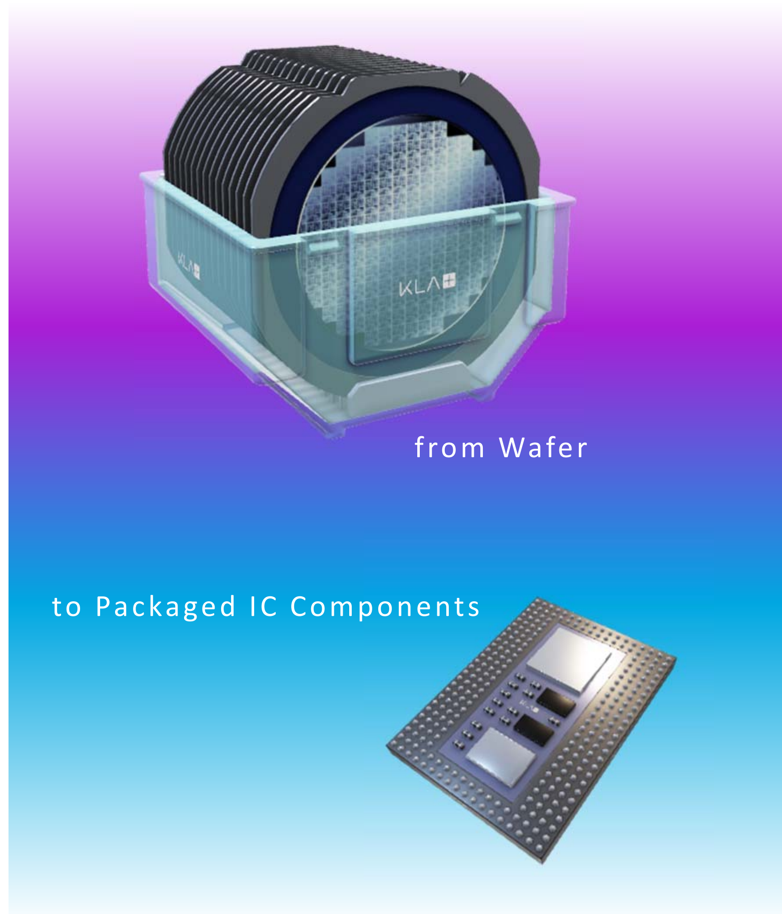
KLA

KLA

Advanced Packaging

Terrific Opportunity for KLA

Advanced Packaging Challenges



- Heterogeneous Integration Multi-Die Yield
- Smaller Features
- New Complex Process Steps
- New Materials
- Larger Packages and Custom Shapes
- Increased Customer Quality Requirements
- Variety of Applications and Package Types
- New Failure Mechanisms
- … and MORE

KLA

Differentiated Product Portfolio

Wafer-Level Packaging

SPTS Delta™
PECVD

SPTS Omega®
Plasma Etch

SPTS Mosaic™
Plasma Dicing

SPTS Sigma®
PVD

Process

Process Control

CIRCL™-AP
wafer
all-surface inspection

Kronos™ 1190
wafer
inspection

Zeta-580
wafer
3D metrology

Final Assembly and Test

ICOS™ F160XP
wafer/tape
inspection, die sort

Die Sort

Component Sort

ICOS™ T3, T7, T8, MV9
tray-tray & tray-tape
Inspection, metrology

KLA

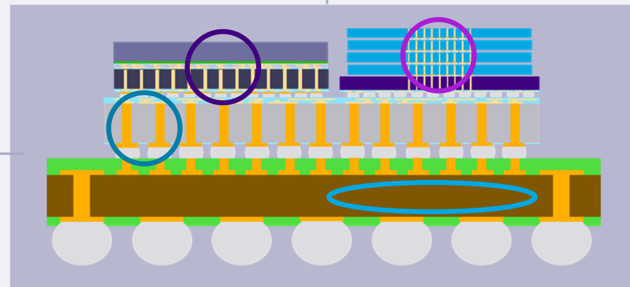
Advanced Packaging Ecosystem

xPU

- 3D SoC with cache memory on µP cores for HPC
- Hybrid bonding for high interconnect density and low power

HBM

- 3D-IC DRAM die stacked on logic
- HBM demand increasing for AI and data centers
- Hybrid bonding expected HVM in 2022-23



2.5D

- 2.5D interposer-based die partitioning with TSV
- Competition by TSV-less interposer like RDL or HD-FO
- Heterogeneous integration

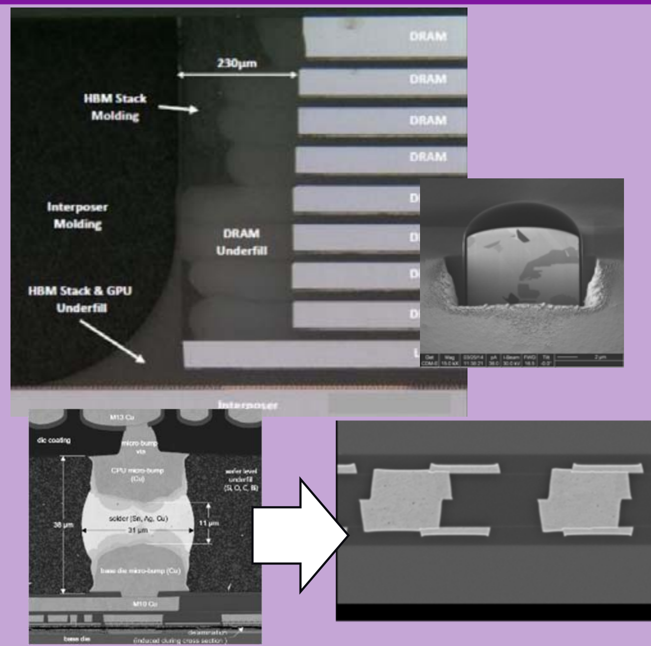
Substrate

- IC substrate scaling to 5/5µm and below
- ABF roadmap for L/S scaling

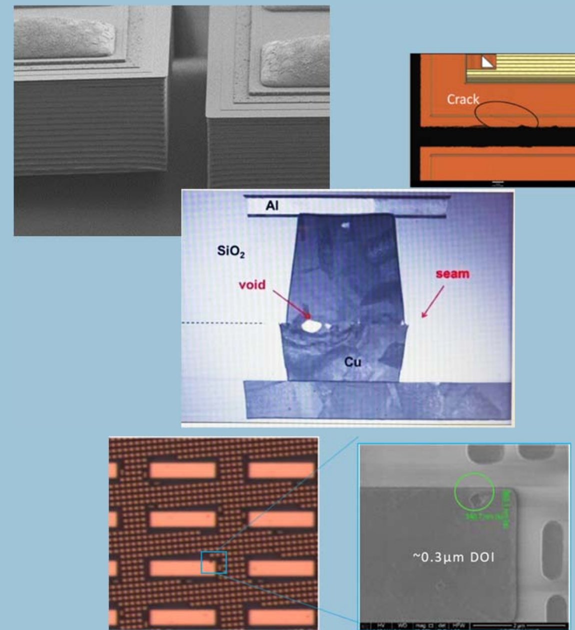
KLA

Advanced Packaging Key Collaborations

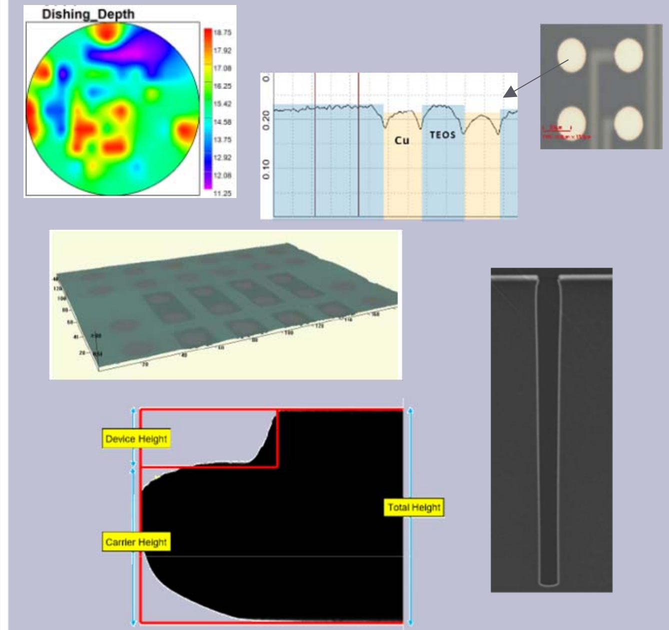
Die Stacking Process



Defectivity Reduction



Metrology and Process Control

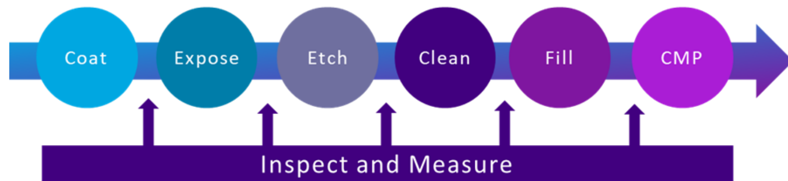


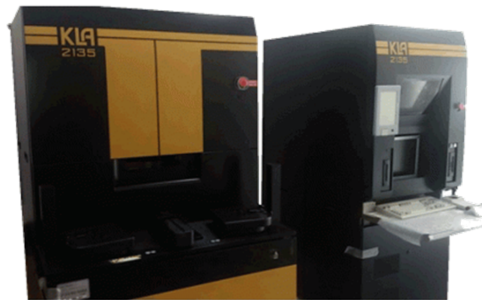
Active Projects with Top5 Semiconductor Companies

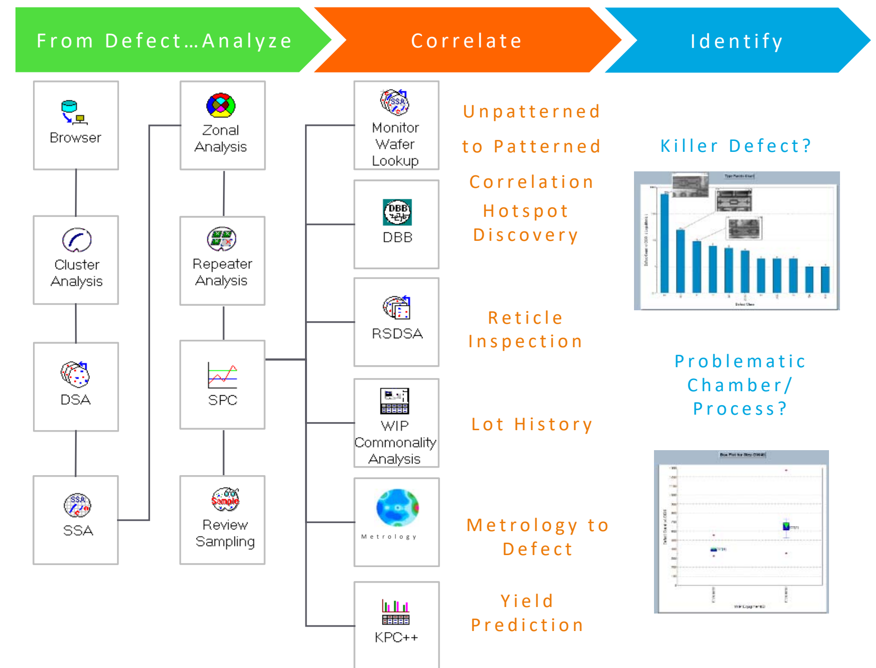
KLA

Data Automation and Process Control will Enter Packaging Fabs

Process Control







Introduced in frontend in mid 90's

Unique Opportunity for KLA to Implement Semiconductor Frontend BKMs

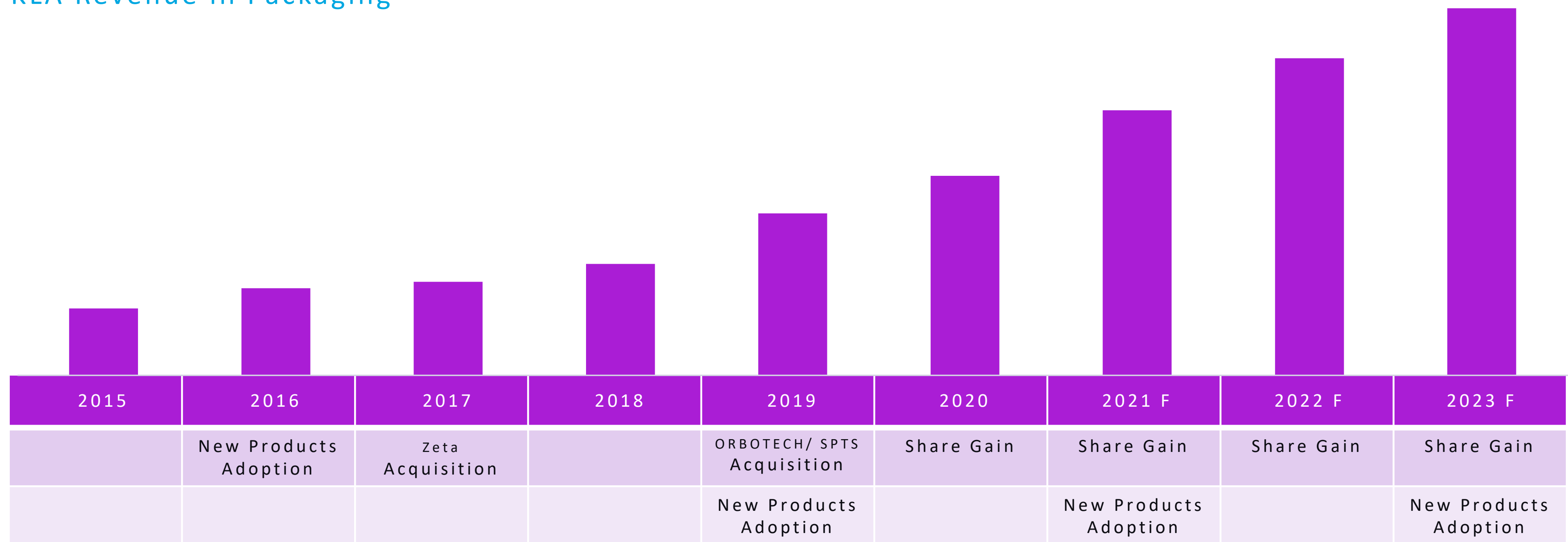
KLA

KLA

Advanced Packaging

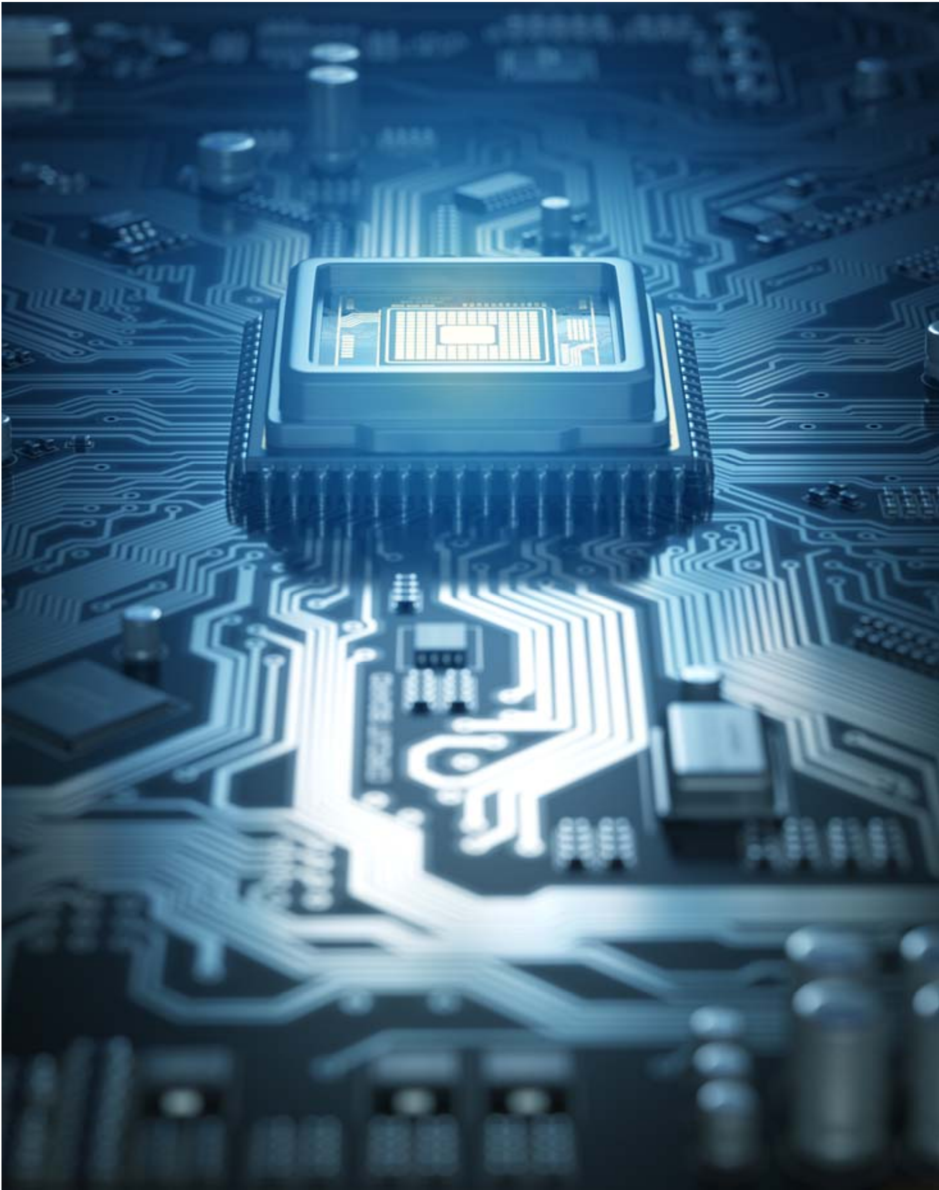
New Growth Engine for KLA

Packaging: New Growth Engine for KLA



>20% CAGR (2019-23) via Organic Growth and Acquisitions

KLA



Thank You

Oreste Donzella, Executive Vice President

EPC Group

June 16, 2021