

# **TOWERjazz**

*The Global Specialty Foundry Leader*

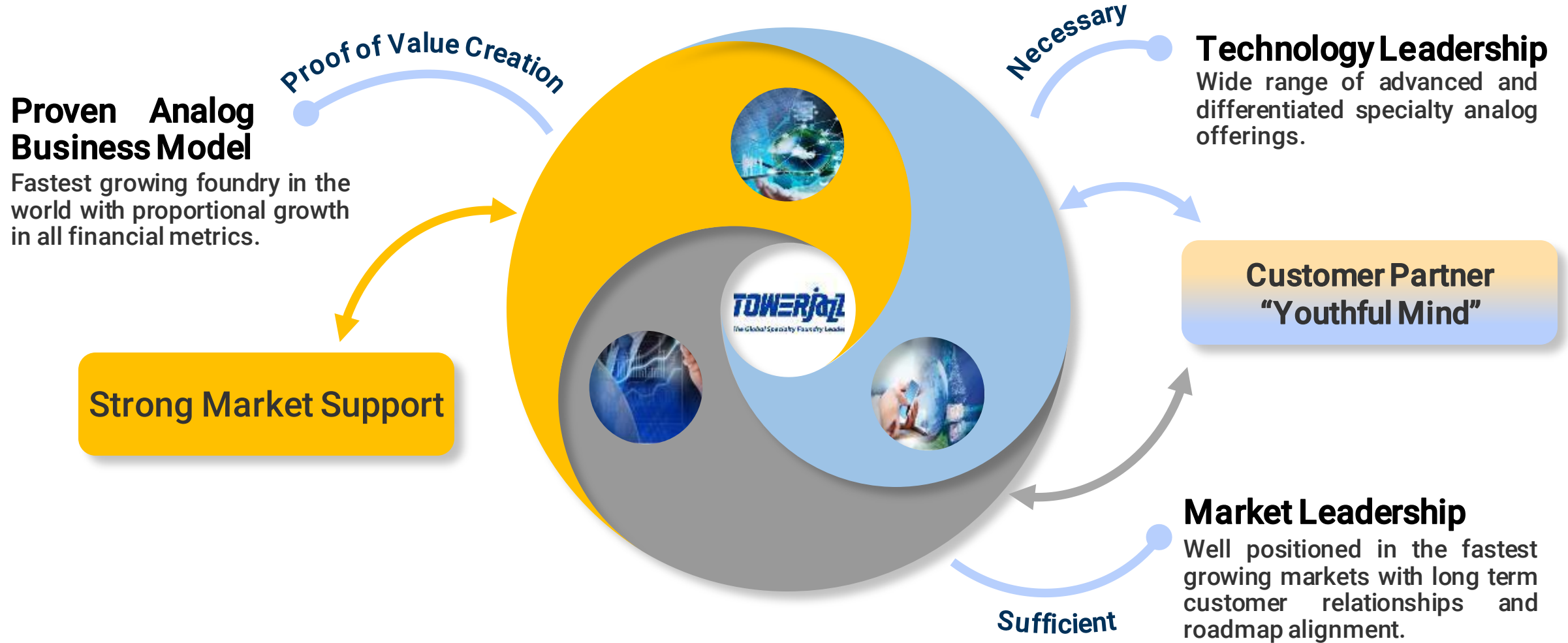
A circular icon with a silver border and a green and blue pixelated pattern inside, representing a microchip or semiconductor.

## **Business Focus/ Growth Drivers**

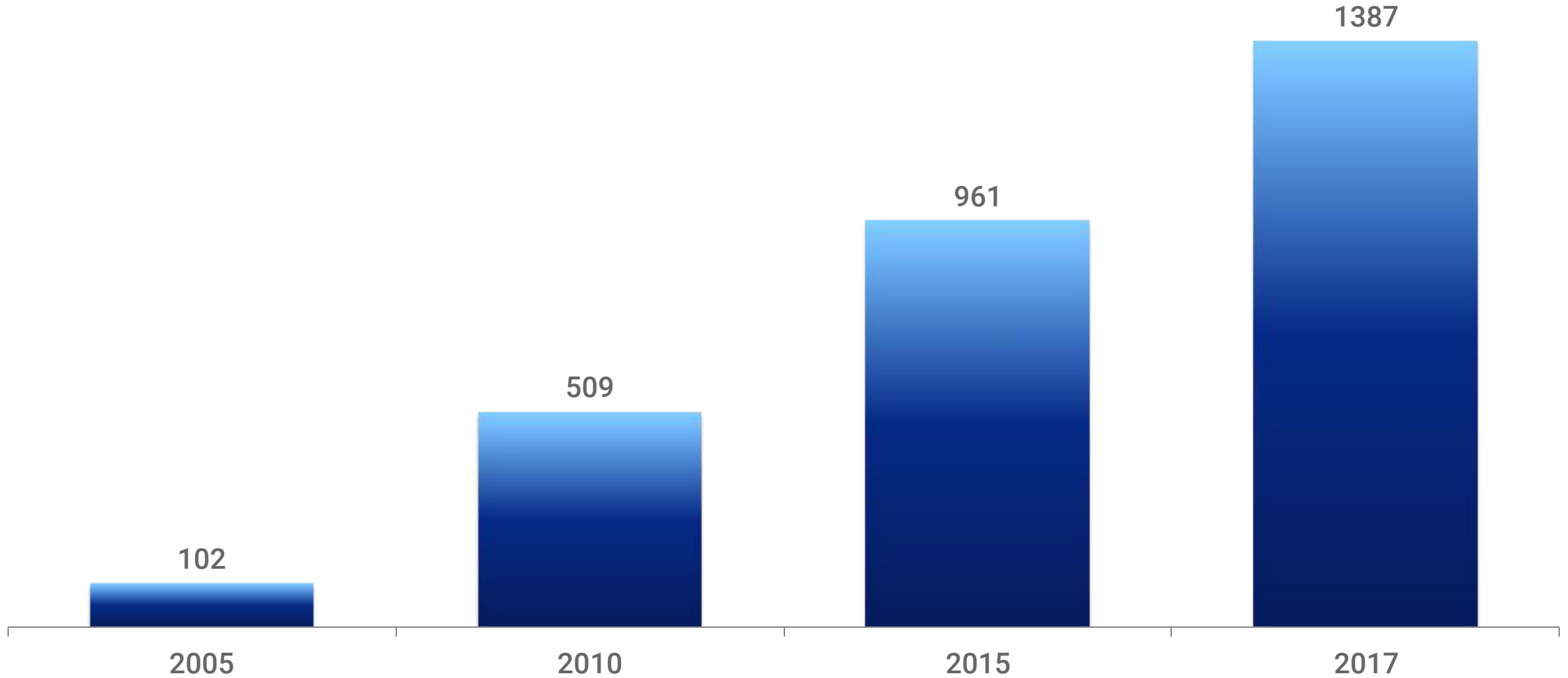
**NASDAQ/TASE: TSEM**

September 2018

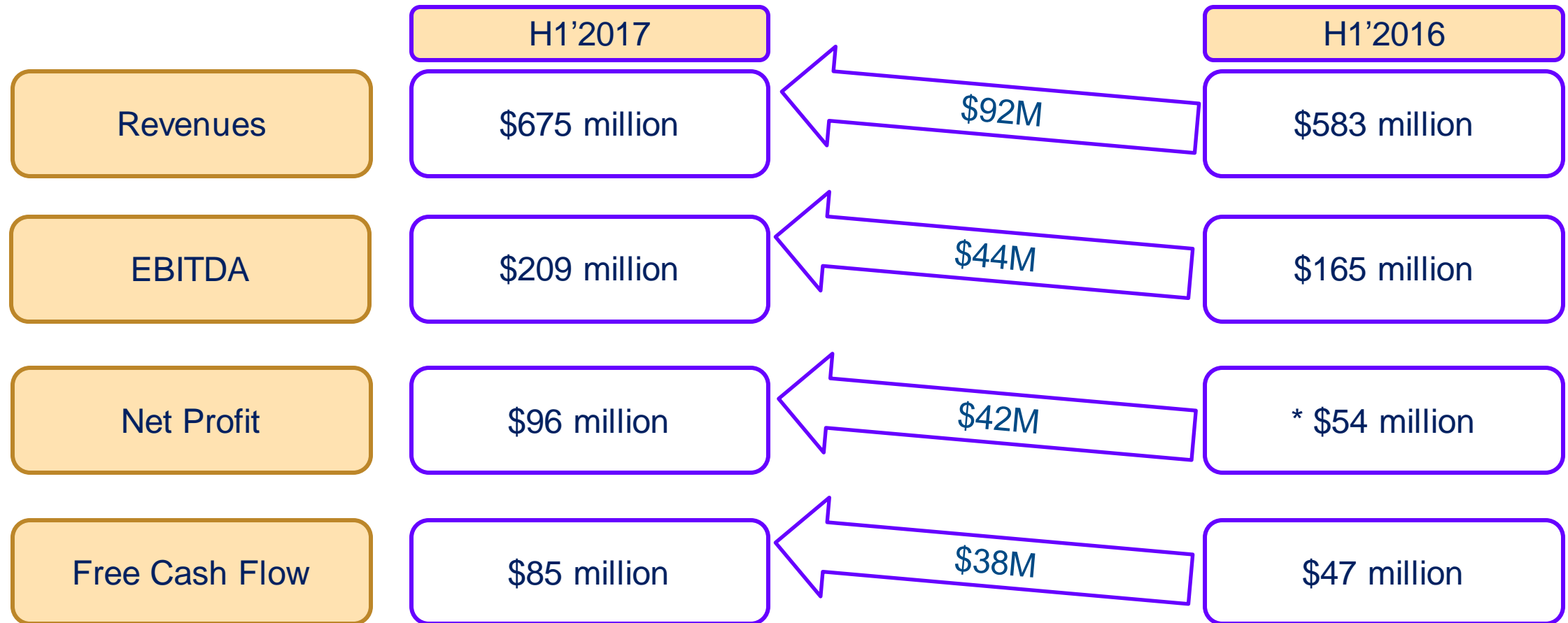
# TowerJazz: The Global Specialty Foundry Leader | Full Circle Value Creation



# Annual Revenues \$M - 5-year tracking till today



# Financial Performance – H1'17 vs H1'16 Comparison



**46-48% incremental EBITDA & Net Profit with 41% incremental Free Cash Flow**

Based on our model, \$92M higher YoY revenue were expected to result in approximately \$46M higher margins, and indeed EBITDA, Net Profit, & FCF were in line with the model and grew by \$44M, \$42M and \$38M, respectively.

# Financial Performance – H1'18 vs H1'17 Comparison

|                | H1'2018       |           | H1'2017       |
|----------------|---------------|-----------|---------------|
| Revenues       | \$648 million | ← (\$27M) | \$675 million |
| EBITDA         | \$180 million | ← (\$29M) | \$209 million |
| Net Profit     | \$64 million  | ← (\$32M) | \$96 million  |
| Free Cash Flow | \$72 million  | ← (\$13M) | \$85 million  |

Based on our model, \$27M lower YoY revenue were expected to result in \$15M lower margins, hence FCF & CF Operations reduction was in line; EBITDA & Net Profit were \$14-17M below model mainly due to:

- Raw Material (Silicon) price increase
- Maxim ToP contractual YoY reduction
- NIS/USD exchange rate effect on NIS related expenses
- Employee market competitiveness

# Financial Performance – Q2'18 vs Q1'18 Comparison

|                | Q2'2018       |       | Q1'2018       |
|----------------|---------------|-------|---------------|
| Revenues       | \$335 million | \$22M | \$313 million |
| EBITDA         | \$96 million  | \$12M | \$84 million  |
| Net Profit     | \$38 million  | \$12M | \$26 million  |
| Free Cash Flow | \$37 million  | \$2M  | \$35 million  |

**55% incremental EBITDA & Net Profit, in line with model**

Based on our model, \$22M higher QoQ revenue were expected to result in \$12M higher margins, and indeed EBITDA & Net Profit were in line with the model and grew by \$12M. FCF increase is lower than expected per model mainly due to timing of payments and collection and working capital funding associated with the revenue ramp.

# Strong Cash Balance and Free Cash Flow

As of June 30, 2018

- Q2 2018 cash from operations of \$77 million and free cash flow of \$37 million and net profit of \$37 million
- Cash (including marketable securities), net of gross debt, as of June 30, 2018, totalled to a record of \$276 million

## Bonds Debt Summary

| Type              | Linked to | Outstanding (\$M) | Key Terms  |
|-------------------|-----------|-------------------|--|
| IL Bonds Series G | NIS       | 122               | 2.79% coupon non-convertible bonds; Final maturity Mar'2023 (through 7 semi annual payments from Mar'2020 to Mar'2023); linked to NIS but fully hedged to be \$122M fixed amount through a \$/NIS swap transaction |
| US Bonds Series   | \$        | 58                | Principal is due December 2018; convertible @ \$10.07 into ordinary shares by Dec'2018   |

## Banks Debt Summary

| Type  | Linked to | Outstanding (\$M) | Key Terms   |
|---|-----------|-------------------|---|
| Credit Line Wells Fargo Bank                                | \$        | 0                 | Libor+1.5% available credit line for up to \$70M draw-downs from Wells Fargo Bank (US)  |
| Term Loan from JA Mitsui                                    | \$        | 40                | Libor + 2.00% term loan from JA Mitsui; scheduled from 2018 to 2022; <b>was early prepaid in July 2018</b>  |
| TPSCo (TowerJazz Panasonic entity) Loan from Japanese Banks | JPY       | 100               | Fixed interest rate of 1.95%; lenders are from JA Mitsui, SMBC & SMTB banks; payable from 2021 to 2025. Large portion naturally hedged by JPY cash balance. |

# **Our focus:**

## **Create value through customer partnership**

1. Protecting and growing high-end share of presently served markets
2. Organically increase into growing new served markets
3. Acquire technologies with capacity or a large raw capacity, to enter new served markets where organic development and/ or CapEx investment would not create ROI.



**Protecting and growing high-end  
share of presently served markets**

# Market Mega Trends

Resulting in rapid growth in specialty analog applications

## Wireless Everything

Seamless Connectivity



## Green Everything

Energy Efficiency



## Smart Everything

Interactive Smart Systems



**Radio Frequency** and  
**High Precision Analog**

**~30%**

of corporate revenues

**Power**

**~30%**

of corporate revenues

**Sensors**

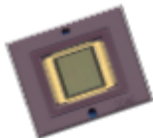
**~15%**

of corporate revenues

# Protecting and growing high-end share of presently served markets

- **Intrinsic to our analog model is CapEx re-use for advanced technologies**
  - **Power discrete:**
    - Strong partnerships with Infineon, Vishay, Semtech, On Semi– where we run and/ or co-developed flows which are kept behind a firewall on long-term, captive agreements
    - CAGR 9,5,3 years: 17%, 19%, 21%
  - **Image sensors:**
    - 200mm smallest global shutter pixel in the world for high growth industrial sensors
    - 200mm BSI partnership in China as a bridge to next generation family of sensors
    - Continued growth in our 200mm major market share dental x-ray activities
    - Ramping 300mm single die per wafer medical sensors to augment already high market share 200mm larger area dental
    - Protecting high market share of studio cameras with transition to 300mm
    - DSLR and large sensor mirrorless: partnering with tier-1 for next generation camera (evolutionary) and a specific G+2 revolutionary performance
    - CAGR 9,5,3 years: 19%, 19%, 23%

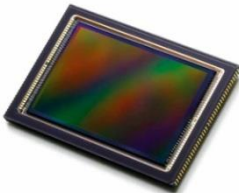
# CIS Application Range



12" wafer size

Medical (X-ray)

Industrial,  
Machine Vision,  
Bar-Code



8" wafer size

Medical (X-ray)

Studio & High End Photography  
Large Industrial, Scientific, Space

Consumer

Professional  
Photography

6" Wafer Size



Prosumer  
Photography

48x36

645



Small Medical

1/24" 1/4" 1/3" 1/2"

2/3"

1"

4/3"

APS (3:2)

35 mm

# TowerJazz Addressed CIS Markets

## Automotive



ADAS and  
Autonomous  
driving

## Industrial / Machine Vision



2D barcode reader  
Traffic control  
Industrial QA  
Food automation

## Medical



Intra-oral  
Extra Oral  
Mammography  
Surgery  
C-Arm and Flouro

## High end photography and Cinematography



Cinematography  
High end DSLR  
Mirror less (ILC)

## 3D, Gesture control, AR/VR



Gesture control  
Augmented Reality  
Virtual Reality

## Security



City safety  
Borders camera  
House safety



# Protecting and growing high-end share of presently served markets

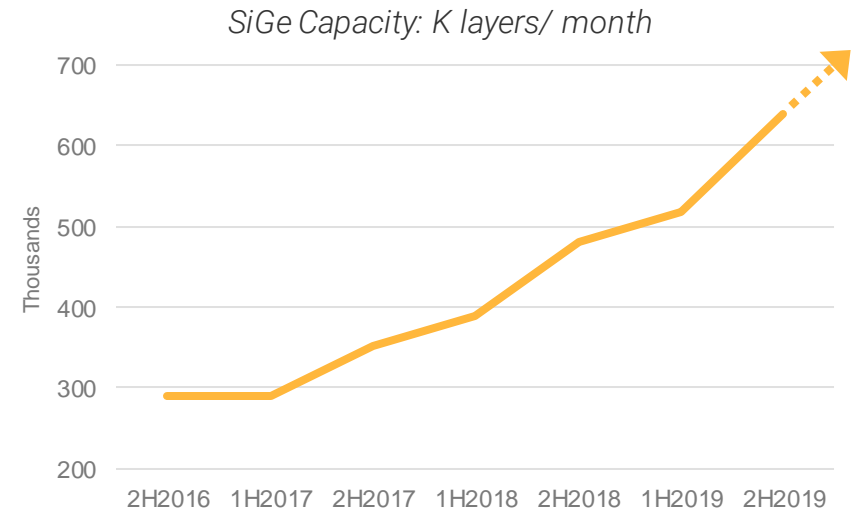
## – RF mobile

- Continue high end RF SOI roadmap
  - 300mm 65nm sub 95fsec RonCoff with high digital capability (e.g. switch LNA combo): ramping presently
  - 200mm QT8 and QT9 high power: multiple tier-1 engagements
- Breakthrough RonCoff MEMS switch (partnering with Cavendish Kinetics)
- New materials with game changing RonCoff: tier-1 FEM provider partnership
- CAGR 9,5,3 years: 12%, 34%, 3%

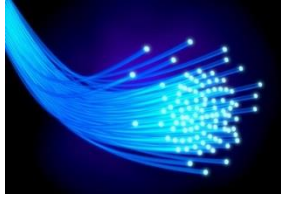


## – RF Infrastructure

- SiGe multi generations capacity increase
  - Press released supply relationships with Broadcom, Inphi, MACOM, Maxim, Maxlinear and Semtech, among others
- CAGR 9,5,3 years: 11%, 12%, 18%



# RF HPA Applications and Technology



## Wireline Front-Ends

High Performance SiGe

- Optical Fiber Networks
- TIA, LA, Laser Drivers, CDRs
- Photodetectors, Photonics



## mmWave

High Performance SiGe

- Automotive Radar
- 5G Wireless
- 60GHz WiFi and Backhaul



## Wireless Front-Ends

RF SOI and SiGe

- Power Amplifiers
- Antenna Switch
- Low Noise Amplifiers



## High Performance Analog

Complementary BiCMOS

- DSL Line Drivers
- HDD PreAmp for the Cloud
- OpAmps, DAC, ADC

# Protecting and growing high-end share of presently served markets

## – Power Management

- Best in world up to 16V 300mm 65nm BCD platform
- Incorporating 1.2V to enable high gate count logic to the otherwise best in the world flow
- Adding high voltage offering of up to 140V breakdown to the 0.18um BCD platform
- Adding advanced reprogrammable NVM to our 0.18um BCD platform
- CAGR 9,5,3 years: 29%, 16%, 8%

Computers & Servers



Consumer



Automotive



Industrial

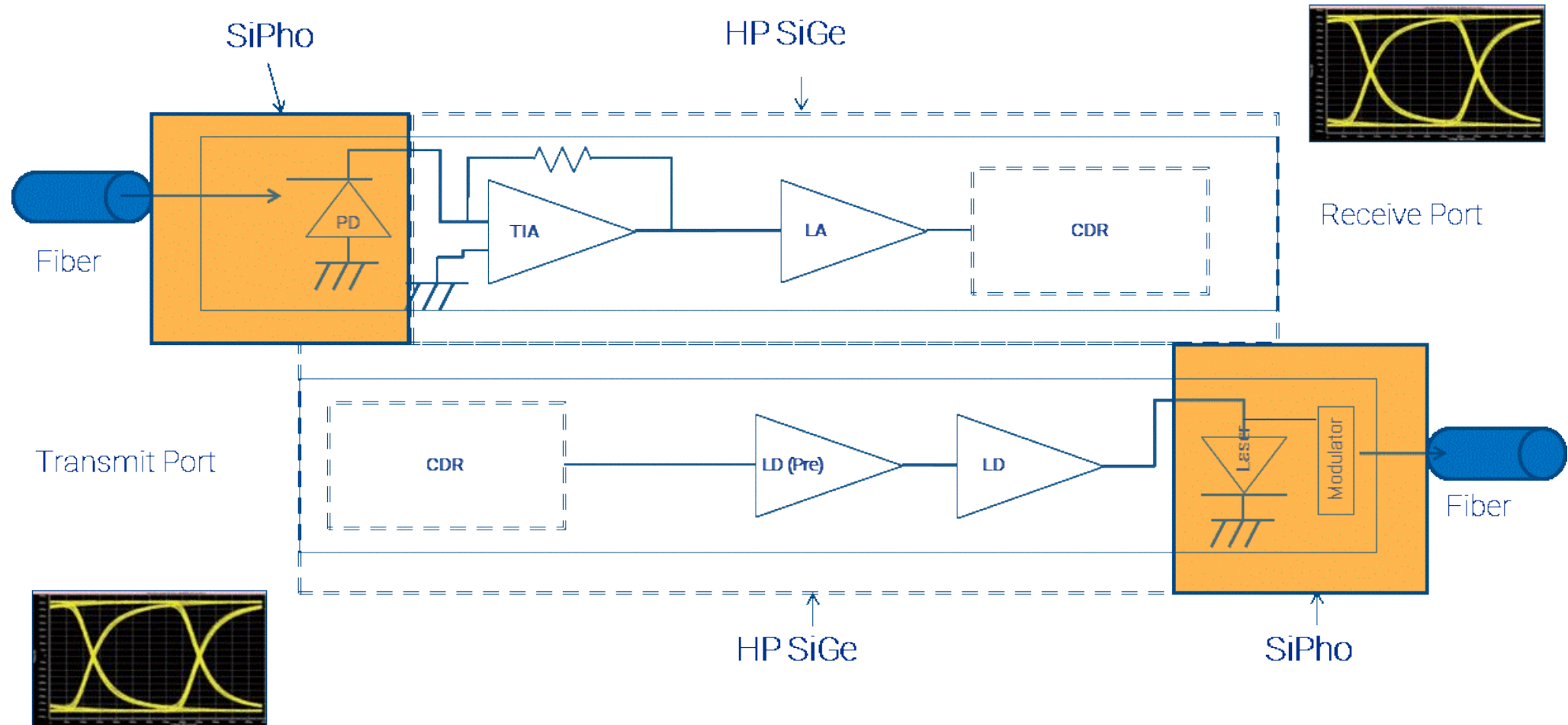




**Organically increase into growing new  
served markets**

# Organically increase into growing new adjacent served markets

- RF infrastructure: SiPho



# Organically increase into growing new served markets

## New Superordinate “Mega” Trends Requiring Enhanced Sensing

### Artificial Intelligence

Experiencing the World Differently



### Augmented Reality & Virtual Reality

Creating Alternative Reality



### Automotive & Autonomous Driving

The sensor fusion experience





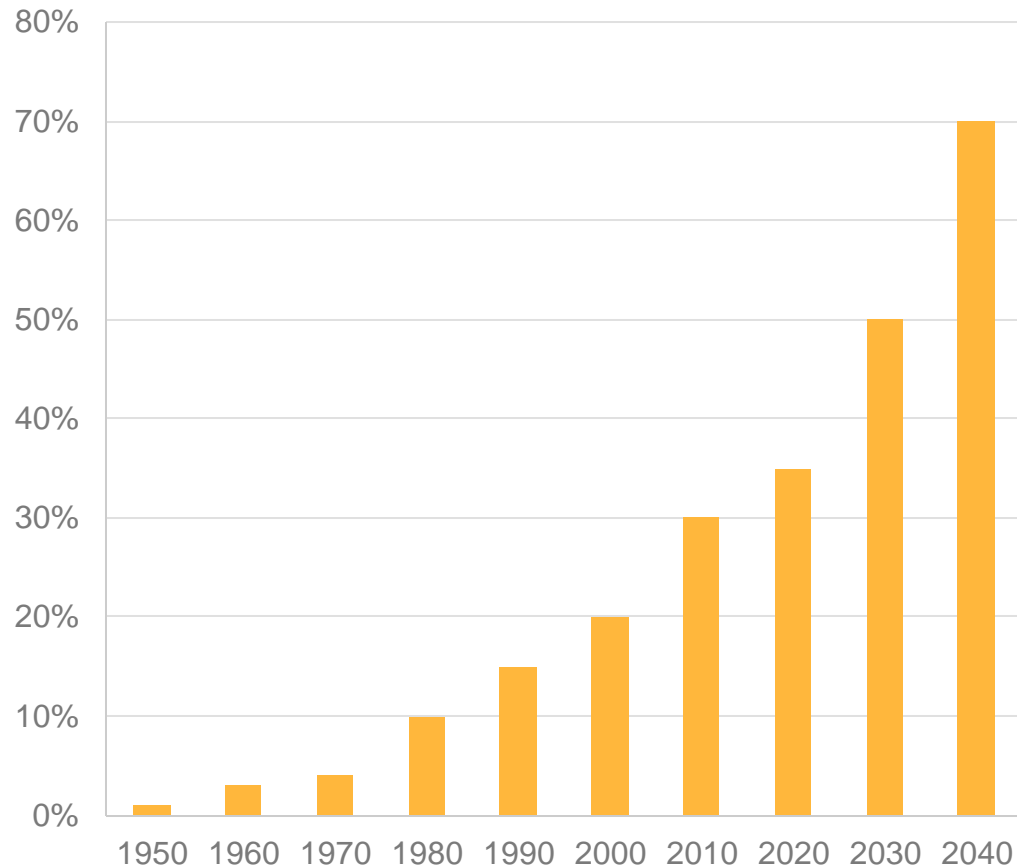
The background image is a blue-tinted photograph of a car, likely a sedan, shown from a side-front perspective. Overlaid on the image are several digital and technological elements: concentric white circles emanating from the front of the car, suggesting sensor range or radar; and vertical columns of binary code (0s and 1s) on the left side, giving it a data-driven or artificial intelligence feel.

# **Automotive & Autonomous Driving**

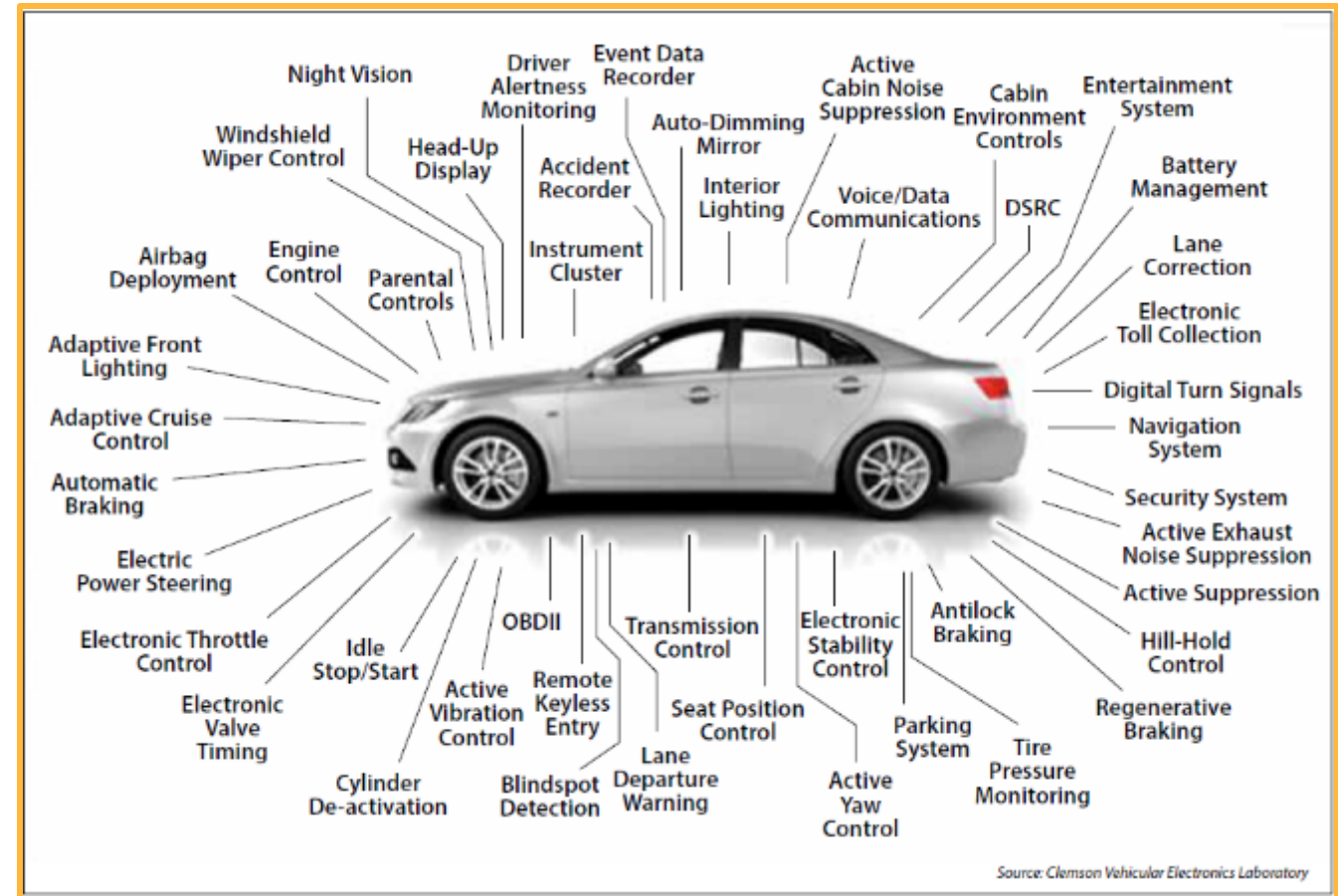
The Sensor Fusion  
Experience

# Digitization of the automobile is driving rapid growth in electronic content

*Electronics as % of Cost in an Automobile*

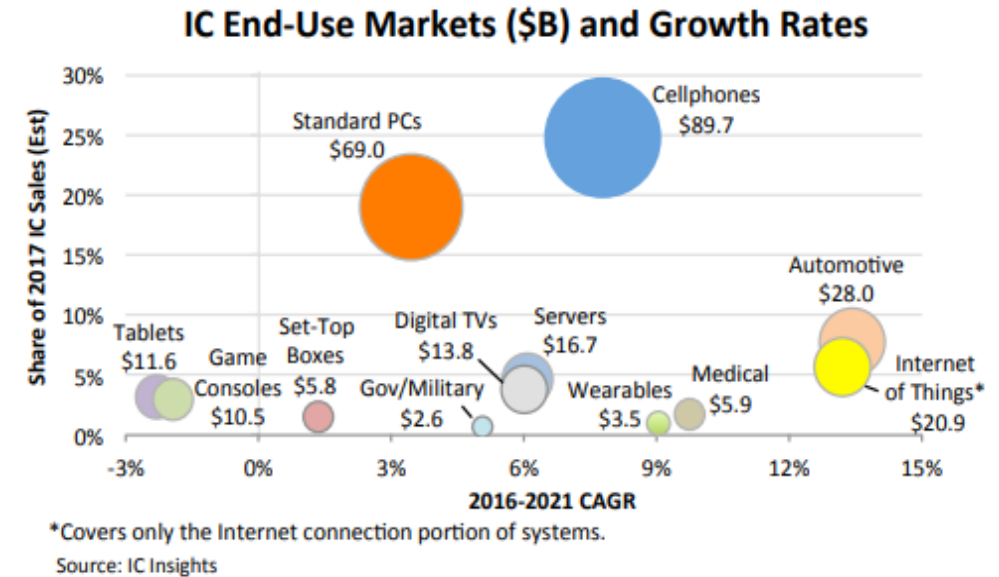


*Automotive Electronics Systems*



# Automotive Market Focus

- Automotive is the **fastest growing** and the **third largest** end-use IC market
- Nearly **70%** of Automotive IC content is **Analog\***, well aligned to TowerJazz Specialty Analog technologies
  - **Power** for EV/Hybrid battery management
  - **RF** for connectivity and Radar (Example: Denso/Toyota partnership announced)
  - **Sensors** for ADAS (Example: FLIR IR night vision partnership announced)



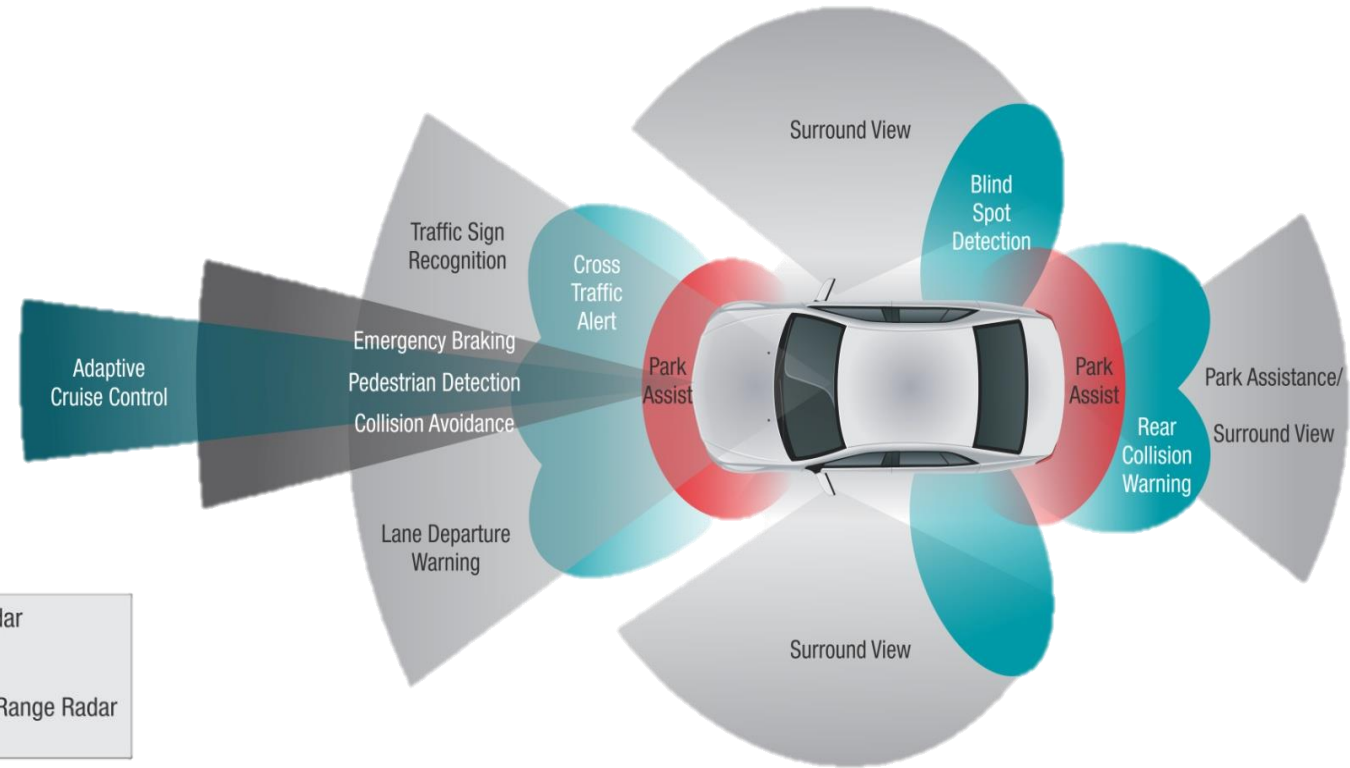
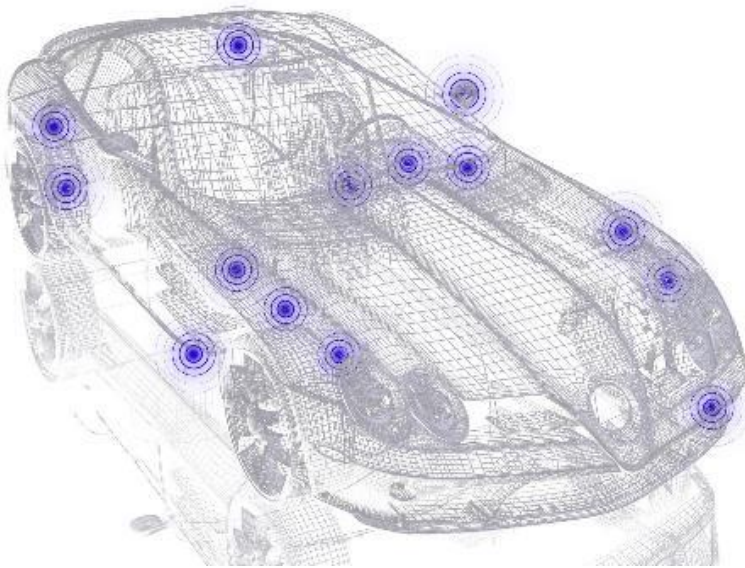
\* MarketsandMarkets report 2017



# Autonomous and Advanced Driver Assistance Systems (ADAS)

360° coverage required | 6-8 cameras per car | VGA moving to HD | High Dynamic Range | Near IR vision | LIDAR for accurate ranging

“TowerJazz’s leading SiGe technology enabled us to create the collision avoidance system which is our flagship offering. TowerJazz’s advanced process enabled the engineers to fully achieve the challenging specs required for next generation short range radar (SRR) for automotive applications. This solution allows DENSO to be a world leader in supplying collision avoidance systems for automotive safety.” (Denso, Director, Advanced Safety Engineering)



“We chose TowerJazz for its advanced pixel technology, specially customized for our CMOS image sensor chips addressing very high volume markets. Together with our technology, we were able to demonstrate a 4X better sensitivity to our customers. TowerJazz’s CIS offering is proven in the industry and we are pleased to manufacture locally in Israel with a leader in the global analog foundry space.” (Newsight Imaging, CEO).



# Augmented Reality & Virtual Reality

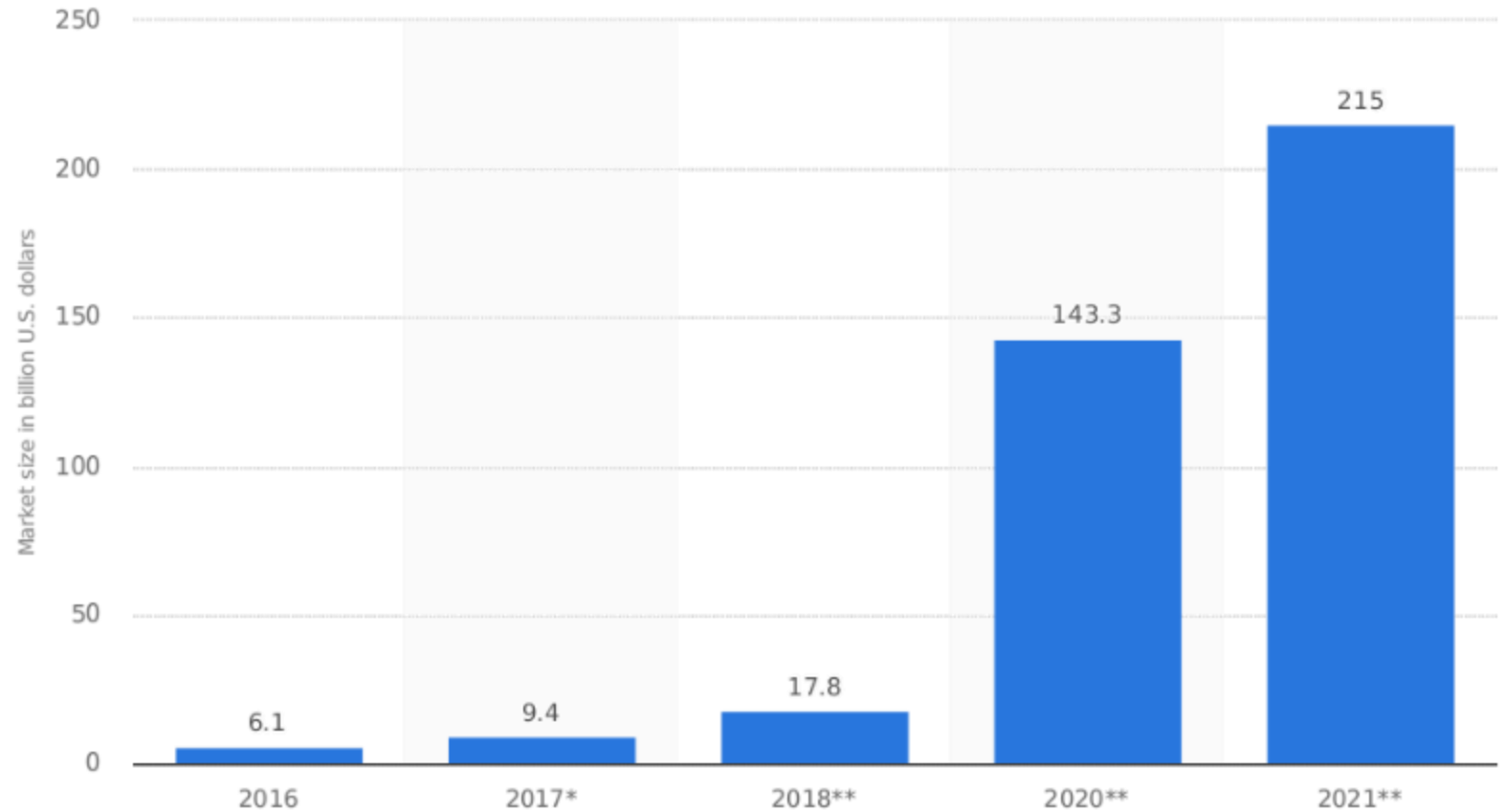
## Creating Alternative Reality





# AR and VR Worldwide Market Size 2016-2021 (\$B)

8X growth  
in the next 2 years



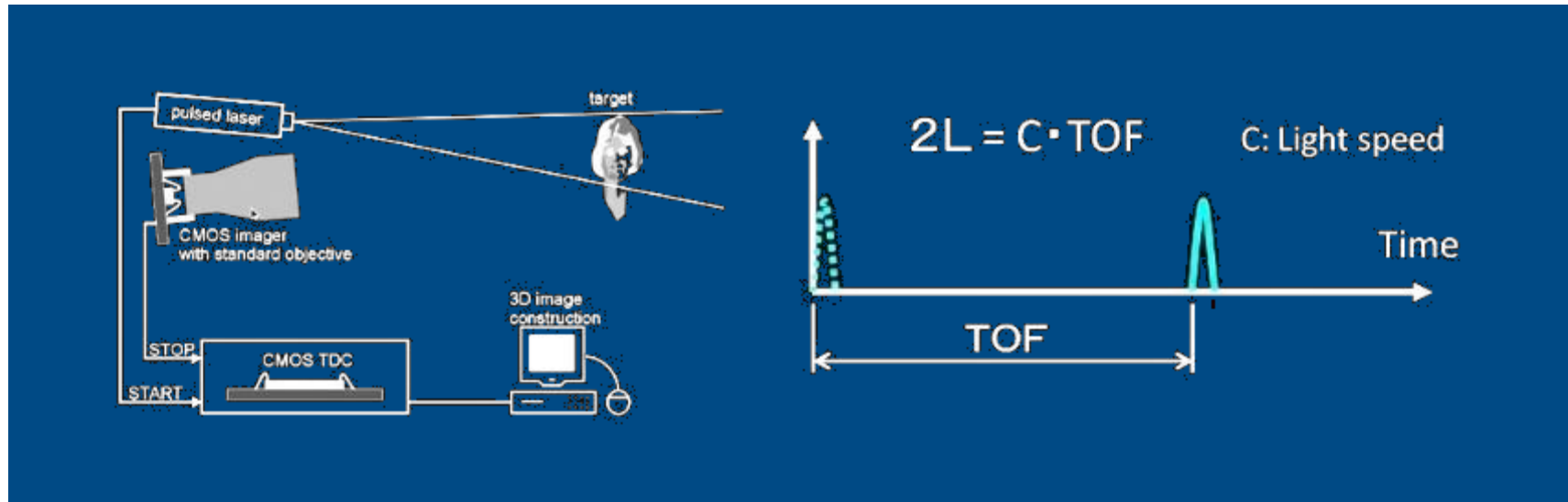
Source  
IDC

Additional Information:  
Worldwide; IDC; November 2017

# AR/VR – 3D ToF sensors and OLED on Silicon displays

## Time of Flight Sensing

- Simple idea: measure the time it takes for light to return from the object
- Two detection mechanisms that trade off between speed and SNR
  - Active Gating: Ultrafast Global shutter technology for real-time imaging, but lower SNR
  - Single photon Avalanche diode (SPAD): Highest SNR but relatively slower due to “quenching” required



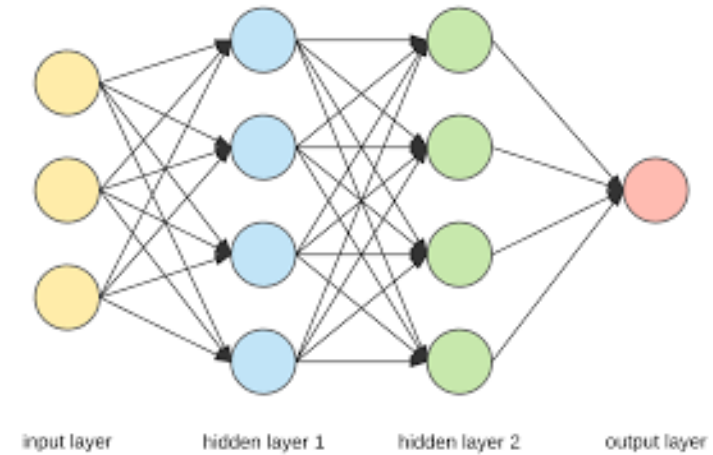
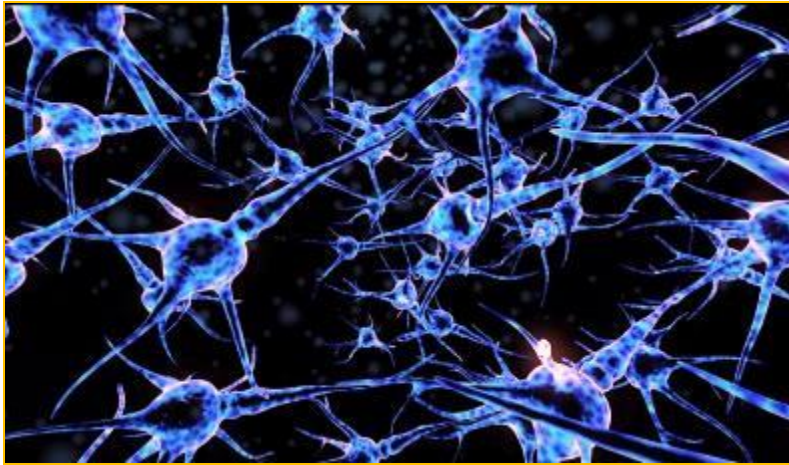


# Artificial Intelligence Experiencing the World Differently

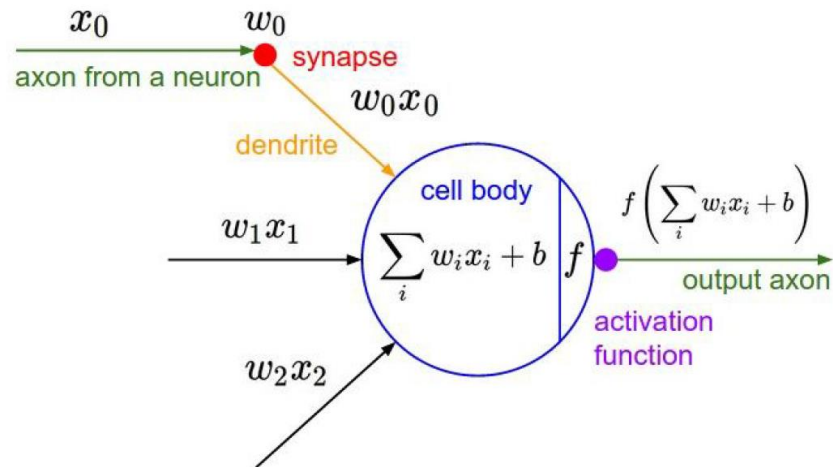




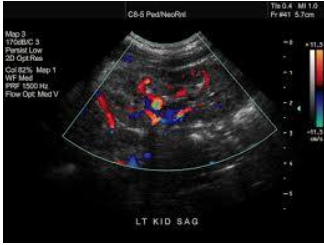
# Analog Neural Network AI processor based on CIS pixels as Neurons



Neuron is a mixed-signal device  
Axon is an analog device



# The Opportunity: Emerging Applications need low power analog AI



AI Medical



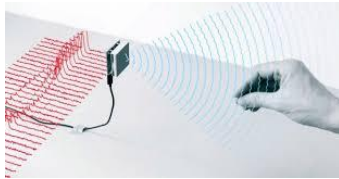
Personal Assistants



Virtual Reality



Portable Navigation



Radar & Optical Gesture Control



Augmented Transportation



Robotics



Drones



Wearables



Insurance



Smart City Sensors



AlaaS



Security/  
Authentication

**Acquire technologies with capacity or a large raw capacity, to enter new served markets where organic development and/or CapEx investment would not create ROI**

# Partnerships and M&A Strategy

## ■ Increase Operational Capacity and Flexibility

- Acquiring capacity at substantial lower cost than organic growth, coupled with long-term supply agreement
- Green field, predominantly funded by partners

## ■ Increase Served Market and Technology Offering

- Acquire new technologies w/ established customer base
- Acquire new technologies which serves existing base
- Acquire existing foundry (manufacturing and business)
- Green field predominantly funded by partners

### Target Acquisitions

High-end technology  
outside of present  
portfolio

Low cost, regional  
focused capacity  
expansion

Under-valued, high  
revenue asset  
acquisition



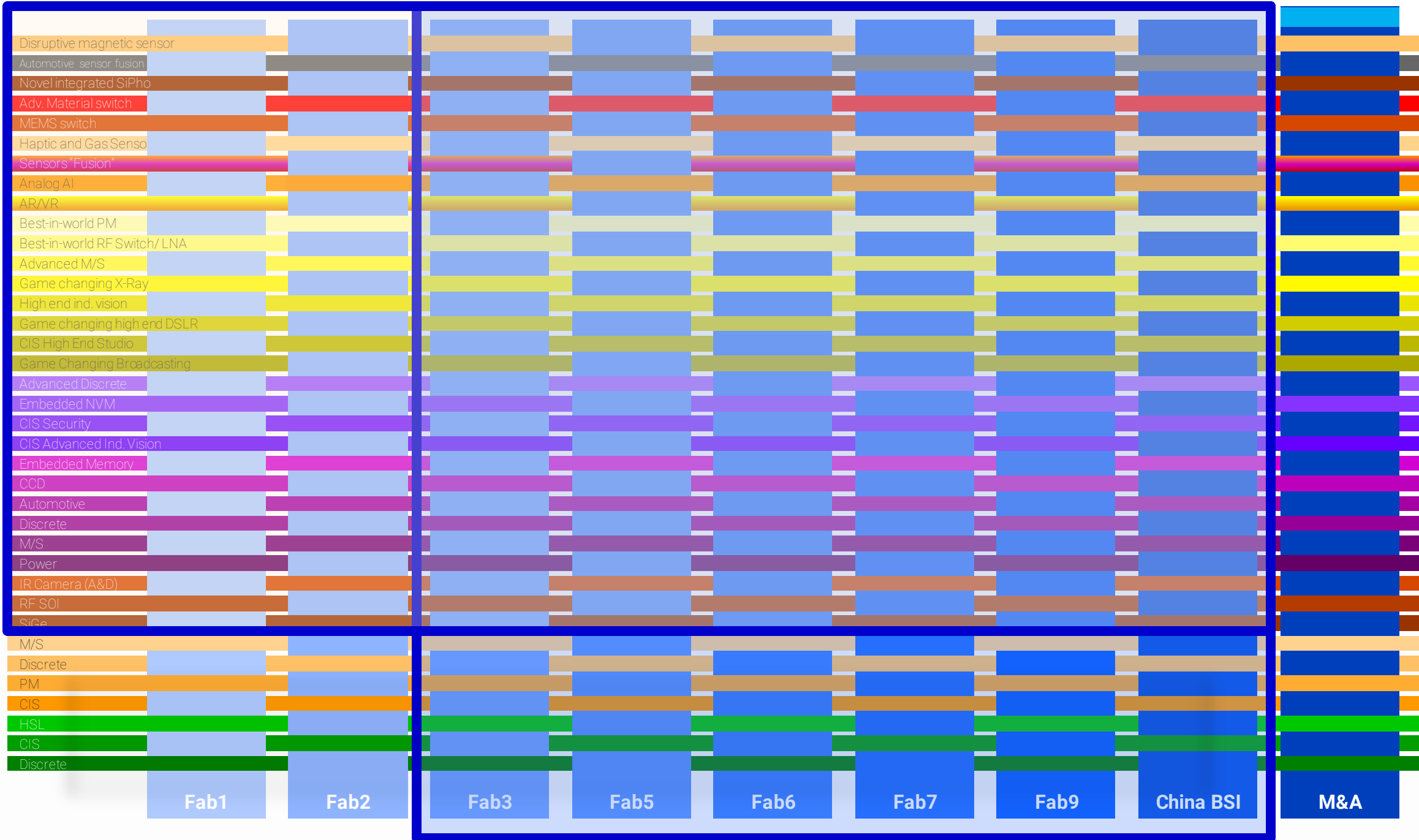
# A song that greatly impacted my life and relevance to TowerJazz

- Tapestry (1972, Carole King)
  - When I was 17 years old; The lyrics touched me deeply, “How do I create a tapestry of my life?”

*“My life has been a tapestry of rich and royal hue,  
An everlasting vision of the ever-changing view  
A wondrous woven magic in bits of blue and gold  
A tapestry to feel and see, impossible to hold.”*









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