POSTER #

Influence of chiplets in the ATE Market

Matthew Getz
Elevate Semiconductor

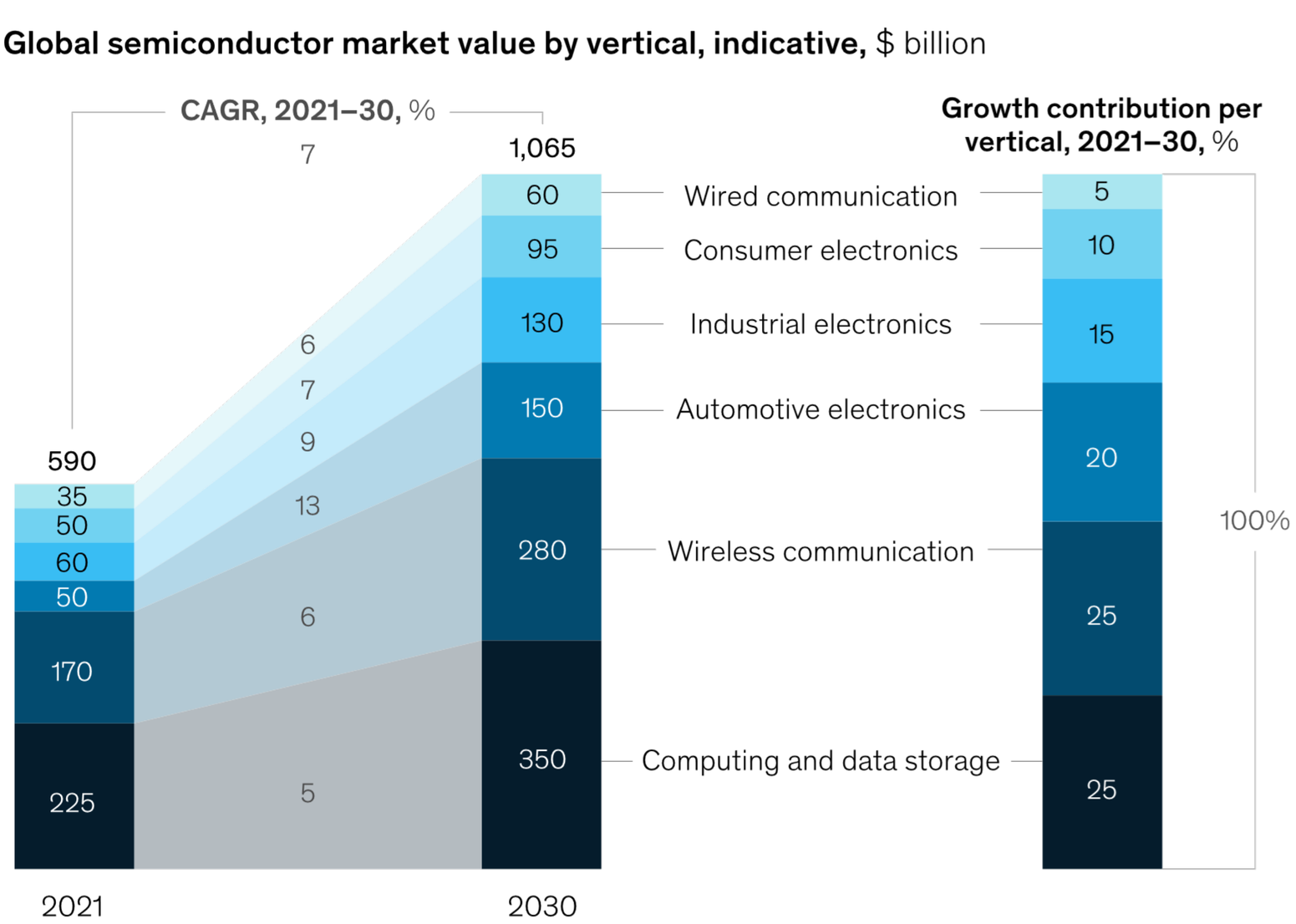
Market Growth

Between 2021 and 2030 there is a predicted growth of semiconductors by 70%. This growth comes from 3 key market segments. Computing and data storage, wireless communications, and automotive all coming with their own challenges for test.

The largest growth is predicted to be in computing and data storage demanding higher density, improved efficiency, and more processing power.

The next area of predicted growth is in the wireless communication and will be driven by faster data rates and frequencies all while being done at lower power.

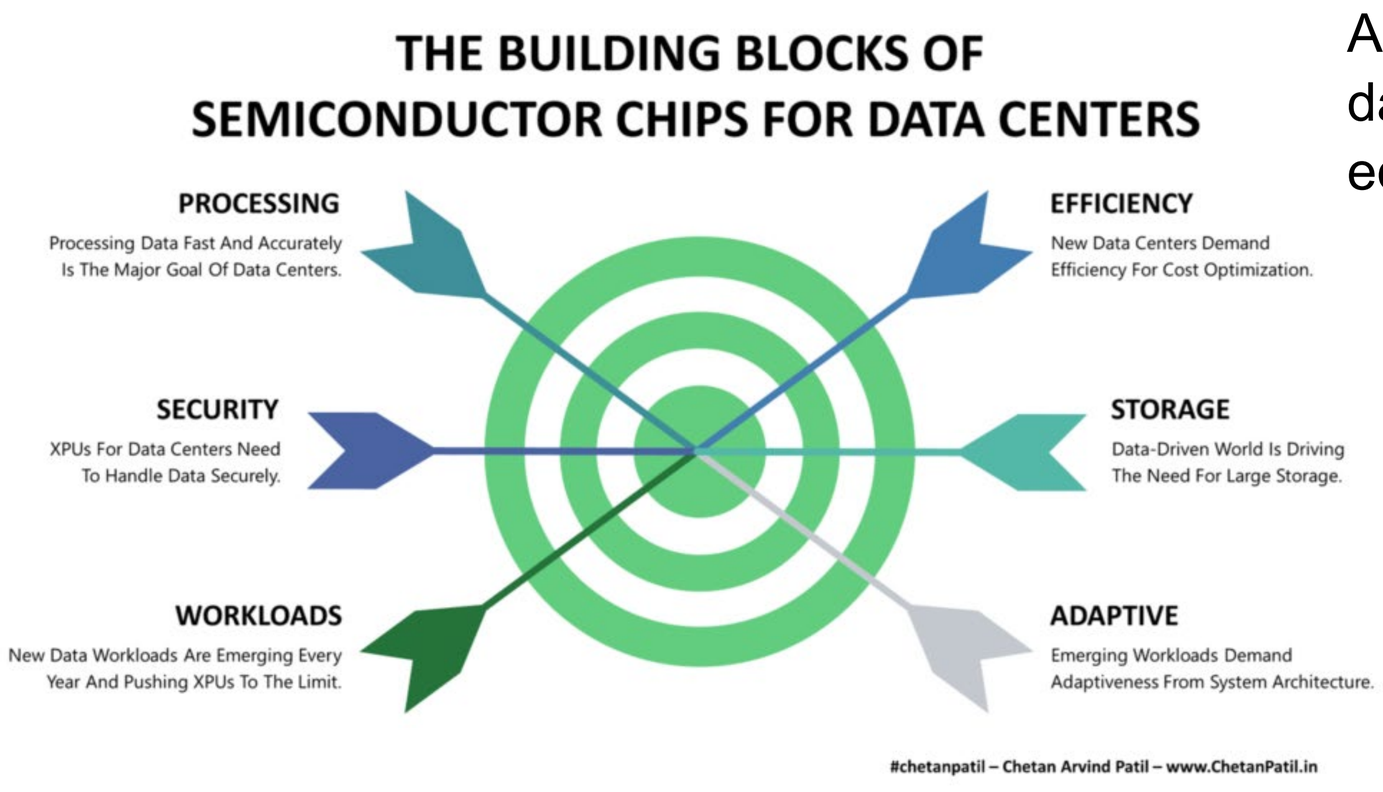
Finally, the automotive electronics market is predicted to have the next largest growth and be driven by both higher power as well as higher accuracy.



Note: Figures are approximate.

Data Storage and Computing- Efficiency and Speed

Several Factors are driving the expansion of the server market, the leading of which is going to be artificial intelligence. Today's modern chips require higher processing power to make more calculations. They require better power efficiency so that more computing can be done in mobile applications or servers can move to air cooling vs liquid cooling. More security is required for protecting IP when shipping data around. This data driven world also requires more storage and the ability to adapt to a given application.



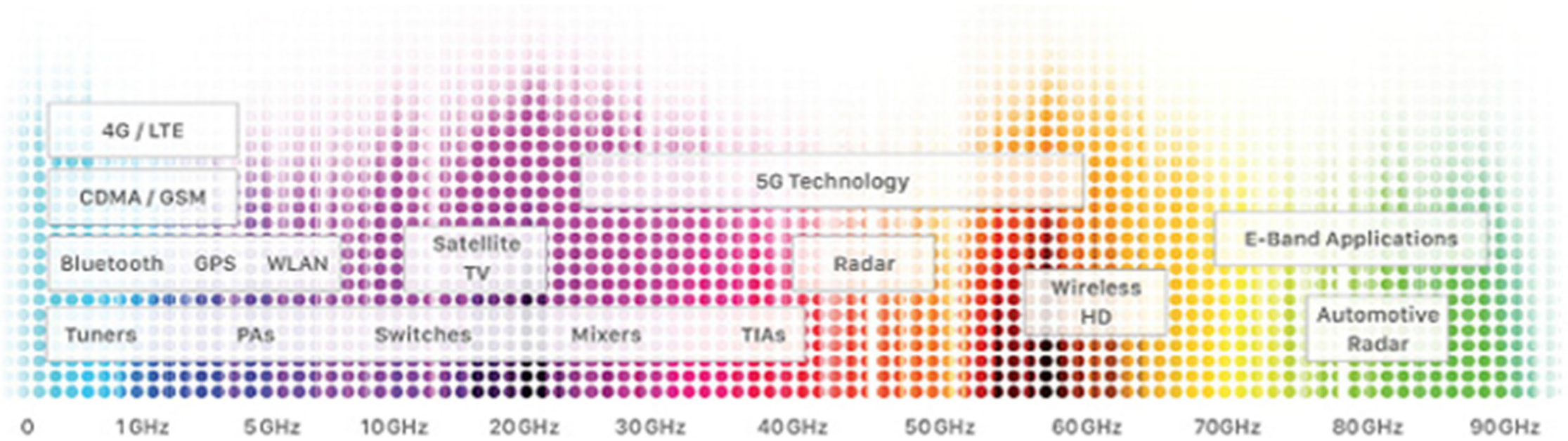
As technology increases and computing and data storage becomes more complex ATE equipment need…

1. Higher Density: To connect to all pins and structures of small pitch BGA processors with 3,500+ pins!
2. More Power: As more data needs to be processed and moved around, and as AI is helping to optimize these transactions, more power up to 1000A+ is required for the testing of these devices
3. Improved Efficiency: As the processors become hungrier for power, less and less can be "burned" during the delivery

POSTER #

Wireless communications race ever faster

Wireless communication is driven by a few different consumer and industry trends. With the emergence of 5G (And 6G to be released ~2030), Wi-Fi6 and Wi-Fi7, and millimeter wave support, the spectrum at which people need to test is ever expanding. This is driven by several standards like the low power wide area network (LPWAN) for increased battery life and range of mobile devices. Vehicle to everything (V2X) which allows high speed communication across “self-driving” cars. And finally, software defined radio (SDR) reducing component cost and allowing for people to innovate when hardware can’t keep up.

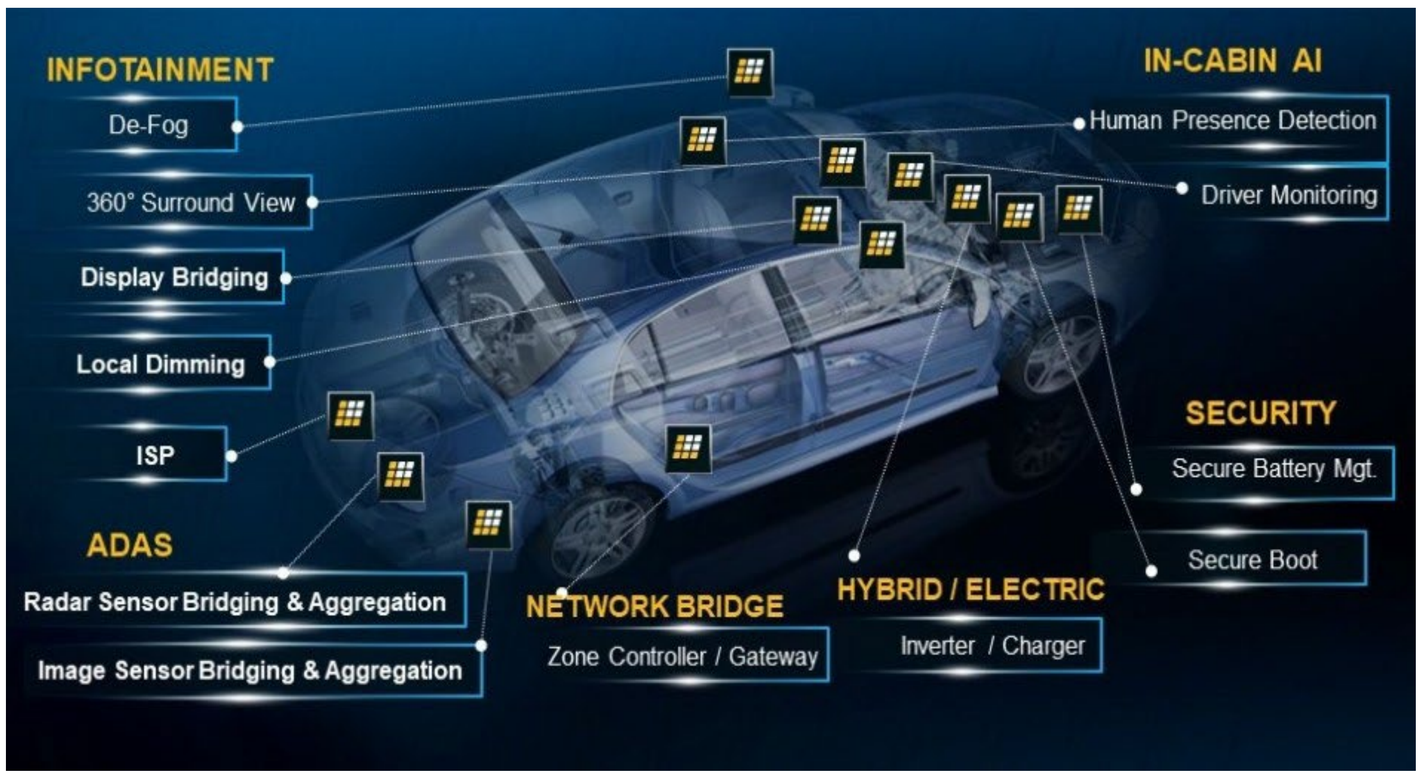


When looking at the test implications of this;

1. Every RF device is going faster as the standards and spectrum change (Moving from 4G/LTE to 5G, evolving from WiFi6(802.11ax) to WiFi7(802.11be), mmWave standards growing from 16GHz to 52.6Ghz, Bluetooth moving from 3.0 to 5.X (SIG) for IoT applications)2.
2. Loss and noise are two of the largest challenges that RF testers must overcome and require increasingly better signal communication between the tester and DUT and low noise power supplies to ensure nothing is coupled to the signals that the RF device is being tested for
3. As more of these devices become embedded in mobile applications, the need for lower power is also becoming more pressing requiring measurements in the 10’s of µV and single nA

Automotive Markets are Driving Power and Accuracy

As automotive technology becomes smarter, more electronics are being integrated into them. RF systems are increasing to help support the requests for Wi-Fi, cellular, GPS as well as Radar and self driving. Rising demand for Electric vehicles is also driving the need for power electronics. Analog electronics for monitoring the battery as well as driving the audio systems (For fidelity and speaker counts) are on the rise in this market. Every newly produced automobile contains at least, at least 10-12 FPGA’s to control all of the systems with at least 5-7 more processors connecting all of the systems together. This doesn’t even include all of the standard electronics for tire pressure sensors, backup camera, mems sensors, and crash avoidance.



For the ATE test market this means:

1. ATE will require higher accuracy to ensure that each cell of the battery pack is at its optimal voltage (Down to the 10’s or 100’s of µV)
2. More and more, floating instrumentation is becoming a requirement for the high voltages of the automotive market as they exceed 100’s of volts
3. Adding sensors (Radar, Lidar, ultrasonic, ect.) to the car increase the need for high speed communications and computation between all of these devices as they race past the MHz to 10’s of GHz
4. The number of systems inside them become ever more complex and numerous requiring more pins to test

POSTER #

Elevate's Solution to the evolving market

In order to keep up with this quickly evolving market, we as an ATE chip manufacture, Elevate is working to manufacture chiplets that can be mixed-and-matched in order to create custom solutions with a very short time to market. We will start by making 3 core chiplets that can be configured in a few different ways. The first of the chiplets would be a converter chiplet that contains references, DAC's, and ADC's needed for all of test. This would be followed by a linear chiplet that would have all of the loop control, force measure circuitry, alarms, and clamping circuitry. Finally, for customers that would like to have a better efficiency, they could add on a switching chiplet with envelope tracking.

Core Data Converter Chiplet

Auto calibrated DAC/ADC
High Accuracy DACs
High Speed DAC
High Accuracy ADC
High Speed ADC
5V Precision Ref & Diff Meter
Digital Ganging
SPI Interface

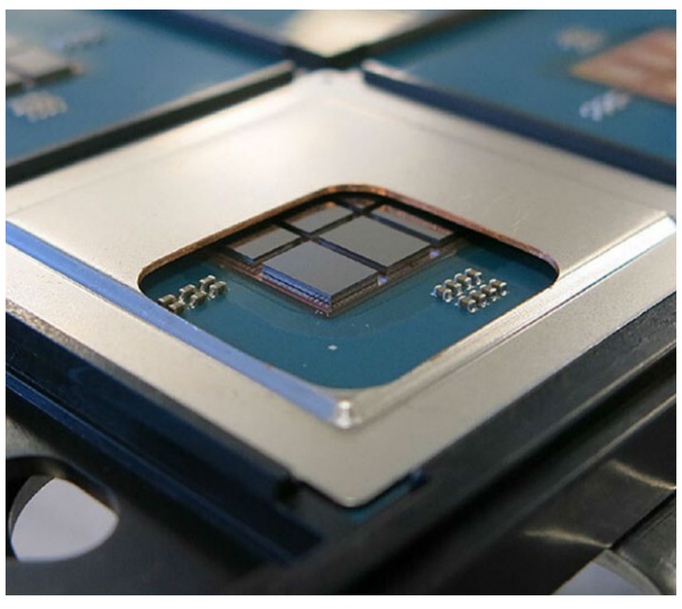
Linear Stage

Class A/B Linear Outputs
Output Stage
Force Loop Control
Measure Circuits
Accurate V/I Clamps
Fast Clamps
Comparators
Guard, Alarms, Temp Circuits

Switching Stage

Switching Class D Supply with Envelope Tracking per channel

As mentioned, there are several ways we are visualizing keeping the core chiplet the same. The first way would be to attach the Core Data Converter to the linear stage and create a linear DPS that would have high accuracy and a quiet output. This would be very beneficial to some of the RF/Automotive requirements that require µV accuracy. Additionally, if that same core concept gets fed by the switching supply, you now have a class H amplifier for the AI applications that require large amounts of current.



Switching DPS

Switching Power Supply Chiplet

Switching Class D Supply
with Envelope Tracking per channel

Linear DPS

Core Data Converter Chiplet

Auto calibrated DAC/ADC
High Accuracy DACs
High Speed DAC
High Accuracy ADC
High Speed ADC
5V Precision Ref & Diff Meter
Digital Ganging
SPI Interface

4 CH Linear Chiplet

CH0
CH2

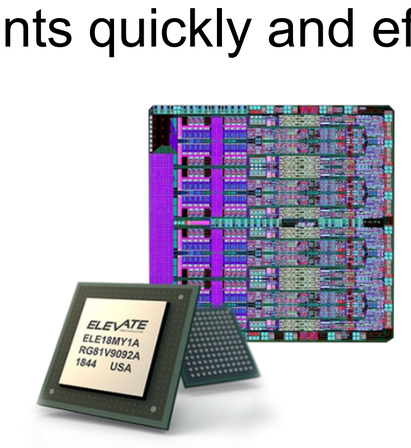
4CH Class A/B Linear Outputs
Output Stage
Force Loop Control
Measure Circuits
Accurate V/I Clamps
Fast Clamps
Comparators
Guard, Alarms, Temp Circuits

CH1
CH3

Additionally, depending on how the market changes, different blocks can be changed to support more channels, more voltage, larger accuracy, better efficiency, or any unforeseen requirements that may arise.

Conclusions

- With the rapid growth in electronics, ATE manufactures need to be agile enough to pivot to the markets demands
- As the data storage and computation, wireless communications, and automotive markets continue to expand to 2030, even more requirements will continue to emerge
- By using well thought out, well designed chiplets, they can be arranged for a family of products to optimize for whatever the market evolves to and support customer requirements quickly and efficiently
- By optimizing our chiplet reuse, the hardware, software, and firmware in designs can be kept constant, while allowing users to create highly customizable solutions so they can have a fast time to market and a competitive solution in their target field



- If you have any more questions contact me at Mgetz@elevatesemi.com