Accelerate the future of automotive systems

Bruce Hsu
GM, Taiwan
Texas Instruments (TI)

April 25, 2019

Accelerate the future of automotive systems

Bringing you decades of experience of solving complex automotive design challenges to get electrified, connected and automated cars to market faster.

500 new automotive ICs annually since 2014

15 manufacturing sites worldwide

350 fully tested, circuit-based reference designs

7,000 automotive-qualified analog and embedded products

Meets rigorous quality certifications, including ISO, OHSAS, ISO/TS 16949

150 automotive systems

6+ years on-time delivery for >95% of product orders estimated ship date

Commitment to functional safety

Accelerate the future of automotive systems

Advanced driver assistance system

Advanced-assist and autonomous-driving capabilities for reducing human error

Passive safety systems

Reliable solutions to increase passenger safety

Body electronics & lighting

Innovative analog and embedded processors to optimize comfort and convenience

Infotainment & cluster

Immersive systems that keep drivers more informed and less distracted

Hybrid & electric vehicles

Reducing emissions by electrifying systems from the car to the grid

TI Automotive Overview

Colin Jan
Director, Embedded Processing
Texas Instruments (TI)

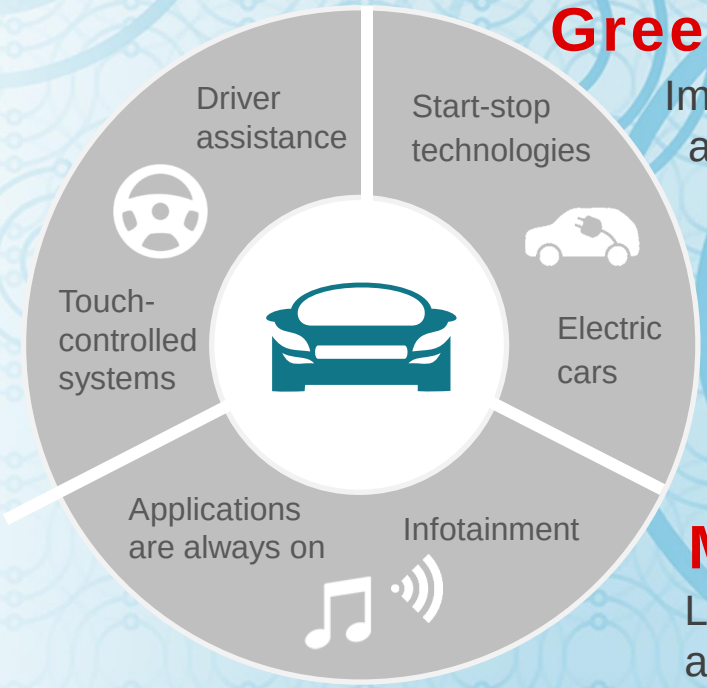
April 25, 2019

TI technology addresses automotive megatrends

TI's technology innovation is making vehicles

Safer

From crash survival to crash avoidance

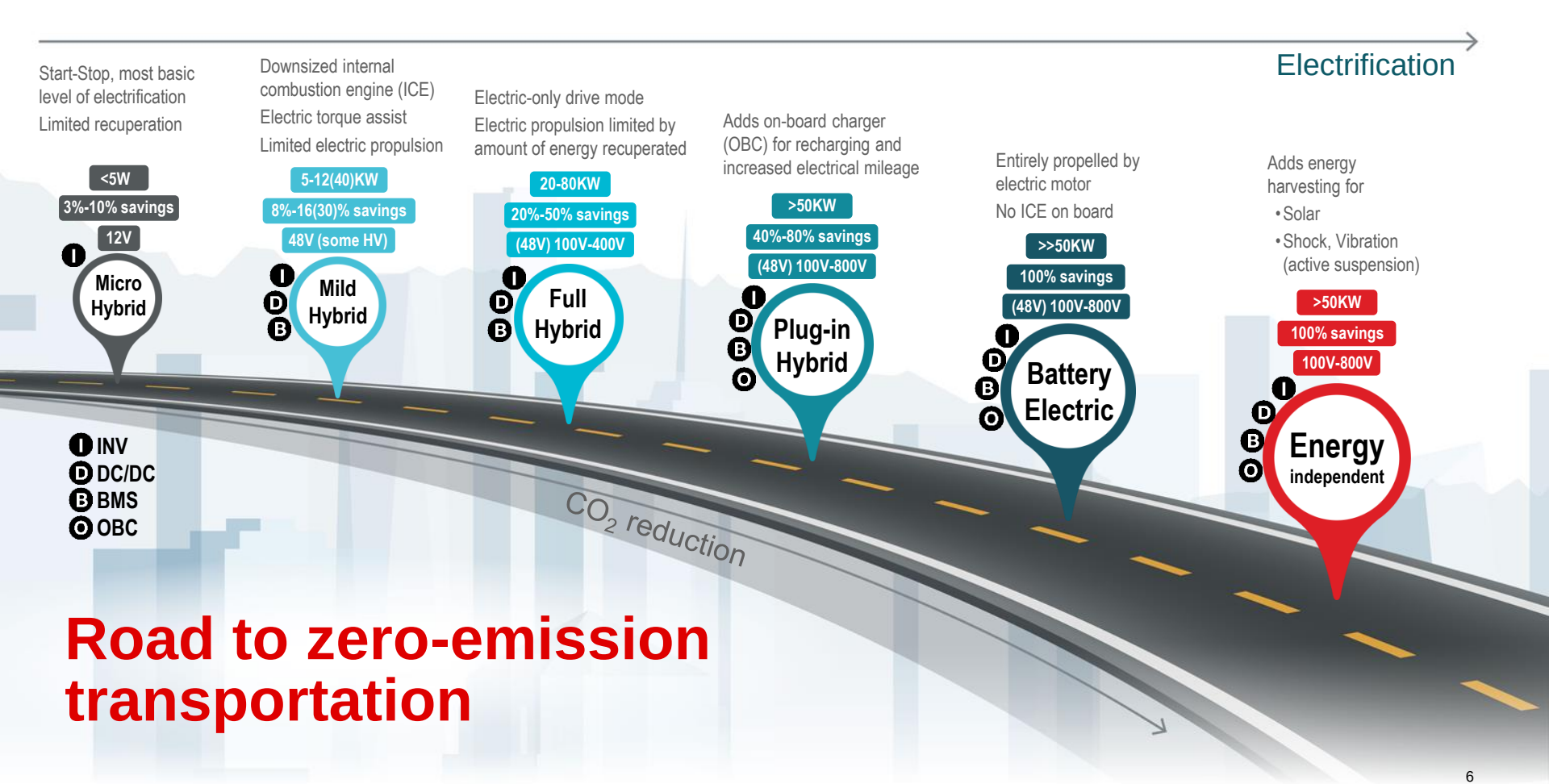


Greener

Improved fuel efficiency and lower emissions

More Fun

Less driver distraction and always-on connectivity



Road to zero-emission transportation

Classifications of vehicle electrification

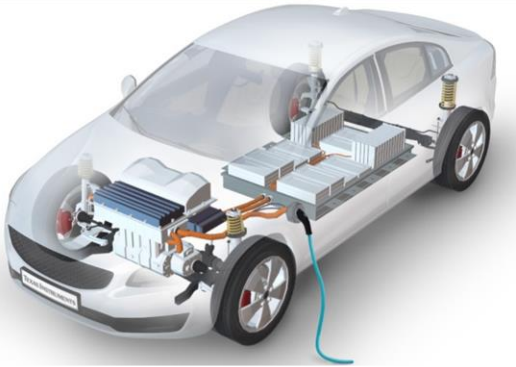
Internal combustion engine (ICE)

Improving ICE efficiency
by improving the combustion process, reducing weight and streamlining aerodynamics.

Hybrid electric vehicle (HEV)

Offloading ICE
by electrifying mechanical components and enabling micro and mild hybrids.

Electric vehicle (EV)



Achieving 100% electric
with plug-in hybrid or fully electric.

Hybrid, electric powertrain systems

Giving you the power to electrify. Accelerating EV and powertrain design by innovating vehicle electrification to reduce emissions, decrease weight and boost efficiency with fewer mechanical components.

Engine management

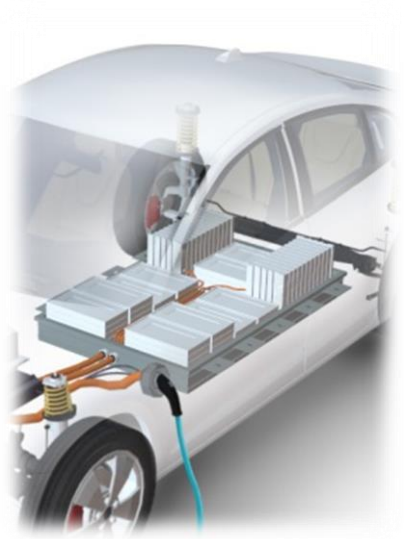
Transmission

HEV/EV

Powertrain sensors

Power steering

New: 6-channel precision monitor with integrated protector evaluation module



BQ79606-Q1 evaluation board

Available now

6-channel precision battery monitor with integrated protector

- Includes daisy chain communication port
- Stackable (up to 64 modules) to support large stack configurations of battery packs

New designs for HEV/EV traction inverter power stages

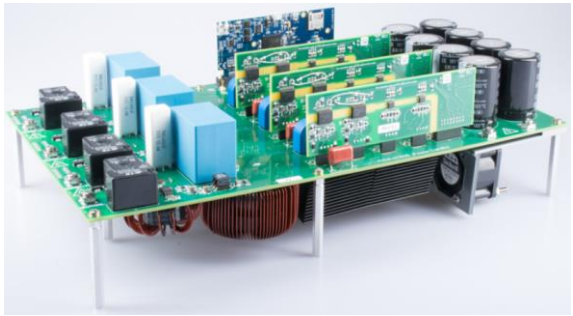
HEV/EV traction inverter power stage with 3 types of IGBT/SiC bias-supply solutions reference design

TIDA-020014

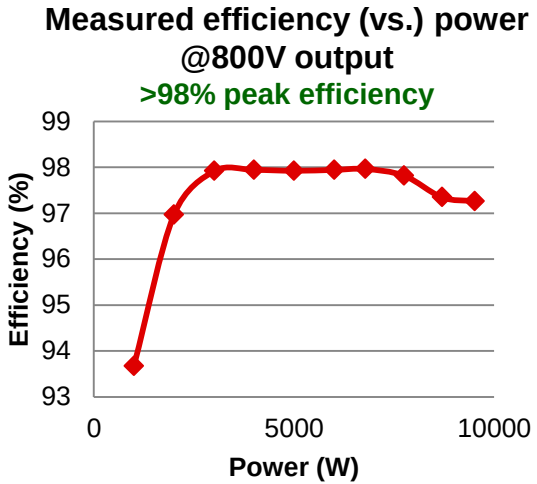
4.2-W, 4.5-V to 65-V input, compact bias supply with power stage reference design for IGBT/SiC gate drivers

TIDA-020015

3-phase SiC reference design for DC fast charging



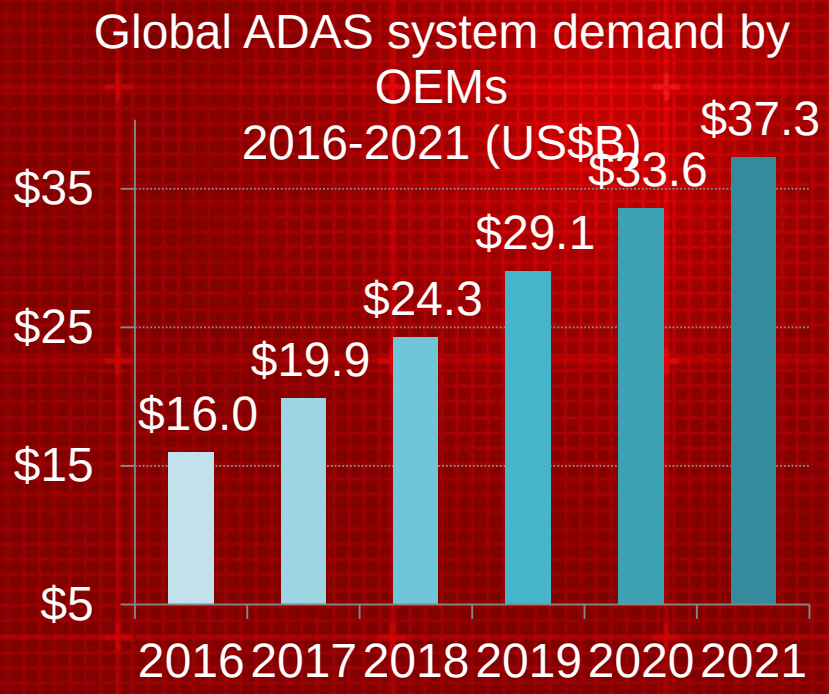
Three-level, three-phase SiC AC/DC converter bidirectional reference design
TIDA-010039



- 98% power conversion efficiency to meet Combo-1 EV charging standards for up to 10kW at 800V DC output
- Silicon carbide (SiC) based design for EV charging (fast-charging stations)
- Provides modularity and ease of bi-directional operation for V2X

The driving forces in the automotive market

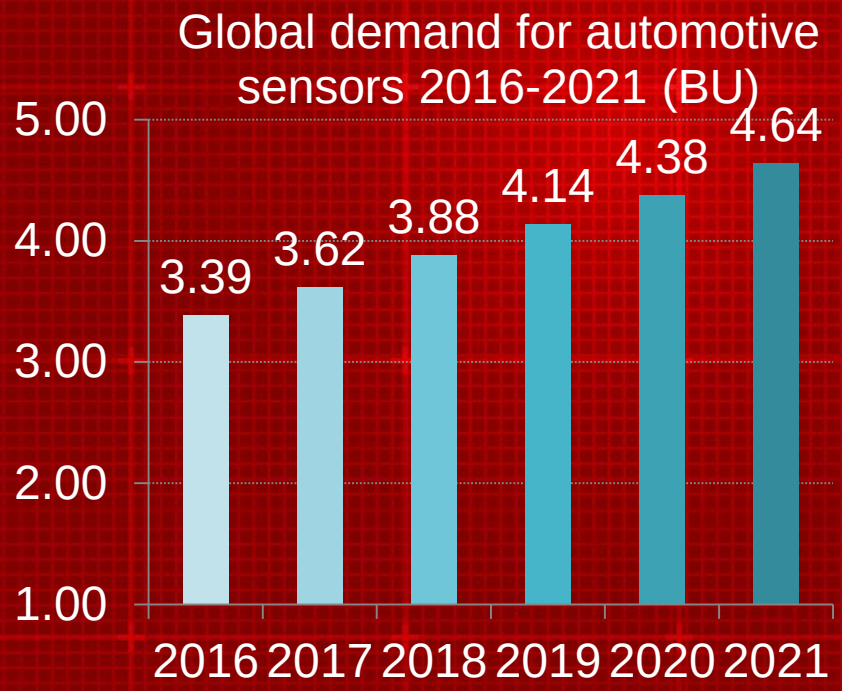
Advanced driver assistance systems (ADAS) will grow to a **$37.3 billion** market by 2021



Source: Strategy Analytics, 2017

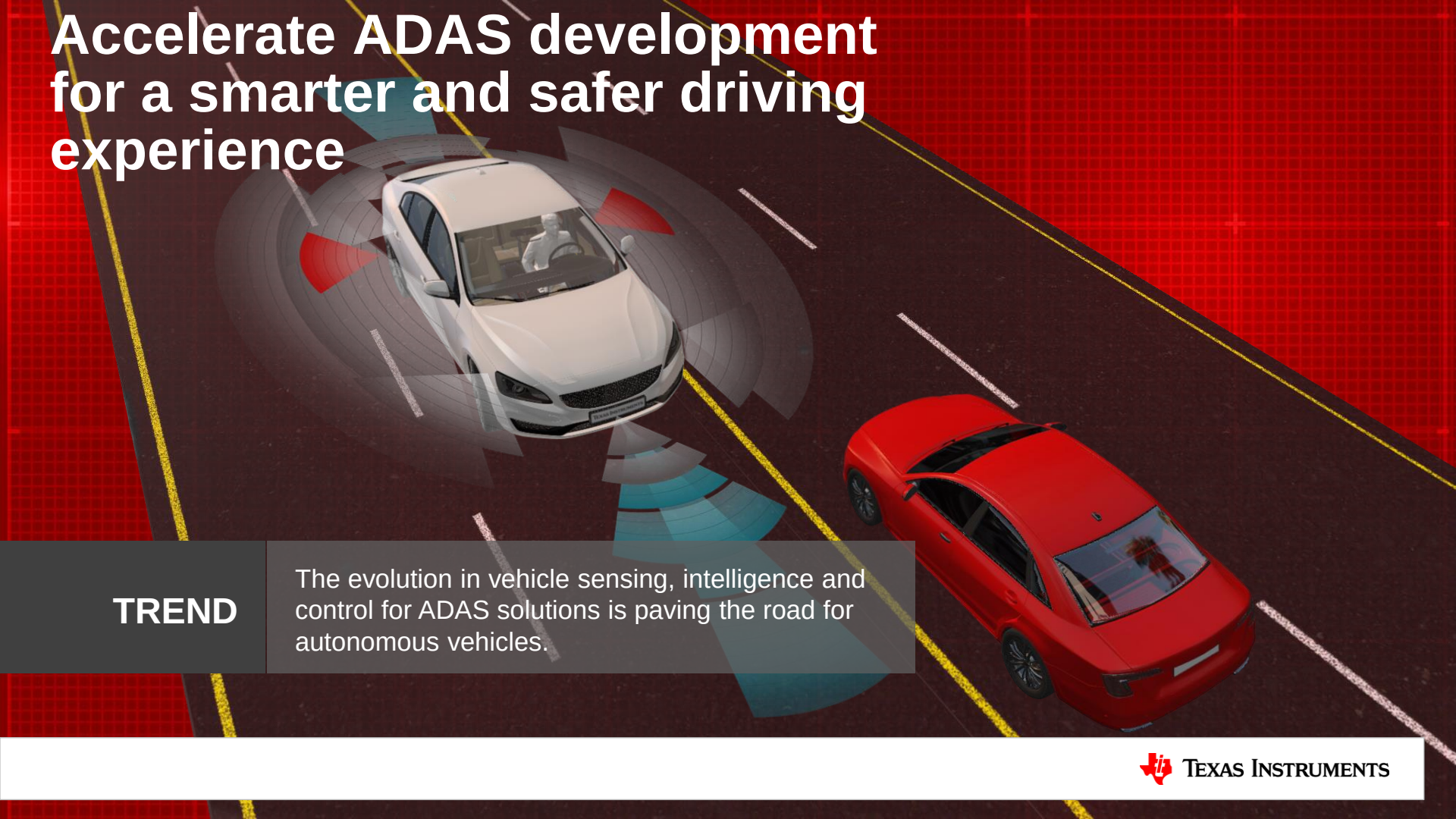
The driving forces in the automotive market

The amount of sensors used in vehicles will grow by **37.07 percent** in the next five years



Source: Strategy Analytics, 2017

Accelerate ADAS development for a smarter and safer driving experience



TREND

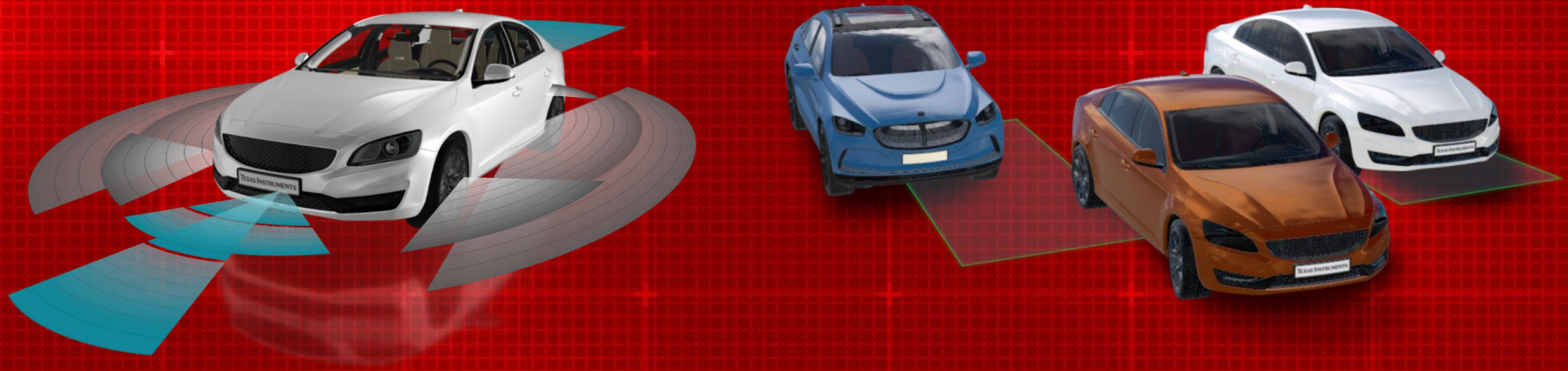
The evolution in vehicle sensing, intelligence and control for ADAS solutions is paving the road for autonomous vehicles.

Accelerate ADAS development for a smarter and safer driving experience

CHALLENGE

Unprecedented levels of automation will require vehicles have the capability to detect complex driving environments. In turn, developers will need to create systems that can distribute and process immense volumes of sensor data in real-time, with unquestionable reliability.

Accelerate ADAS development for a smarter and safer driving experience



SOLUTIONS

TI offers ADAS solutions for camera-based (front camera, rear and surround view systems, mirror replacement and driver monitoring) and radar-based (blind spot warning and collision avoidance) technologies as well as sensor fusion and autonomous driving.

Accelerate ADAS development for a smarter and safer driving experience

Safety-related semiconductor components

Safety-related documents, tools and software

Quality-manufacturing process

Complementary embedded processing and analog components

Safety development process

SOLUTIONS

SafeTI™ design package can help make it easier for ADAS designs to meet regulatory and functional safety requirements.

Automotive Radar Applications/EE

CORNER RADAR

- Single chip radar sensor solution
- Integrated DSP, Memory
- >130m Range using single chip
- ~170m using 2 chip

IMAGING RADAR

- Cascaded radar sensor solution
- >350m Range
- < 1 deg angular accuracy

RADAR FOR PARKING

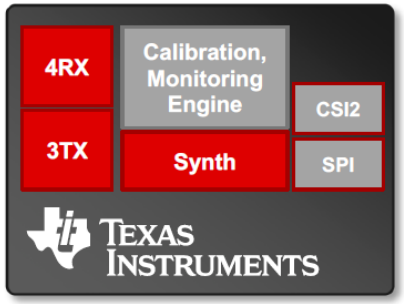
- Antenna on package solution
- Multimodal/Multi functional
- High resolution and wide field of view

Body & Incabin Sensing

- Automatic Door opener
- Driver Vital Sign Detection
- Occupant Detection
- Gesture detection

Automotive mmWave Sensors

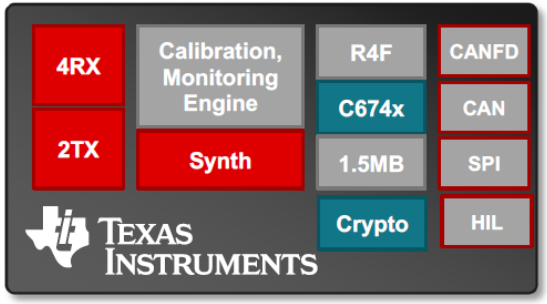
AWR1243



Radar Sensor

- **Use Cases**
  - Imaging Radar Sensor
    - 2x or 4x AWR12 (cascade) + External DSP
  - MRR and LRR
- **ASIL-B capable**
- **PPAP/Production: Now**

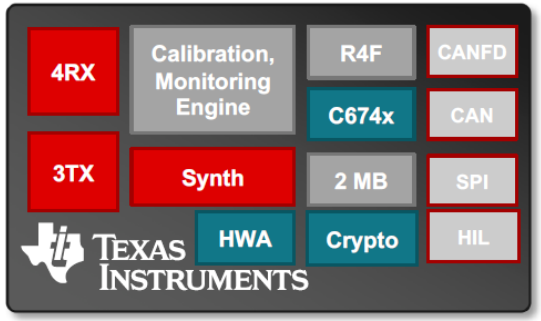
AWR1642



Radar Sensor + DSP

- **Use Cases**
  - SRR Single chip Radar
    - 100m Cross traffic Alert
  - Body sensing, Occupant sensing, Vital sign monitoring
- **ASIL-B capable**
- **PPAP/Production: Now**

AWR1843



Radar Sensor + DSP

- **Use Cases**
  - Parking w/ height measurement
  - MRR single chip radar
- **ASIL-B capable**
- **Sampling: July 2018**
- **PPAP/RTM: 2Q19**

Target ADAS Applications

Core Applications

Front Camera

Scalable Performance
Low Power
Safety

Surround View

Integrate 3D Graphics
Scalable Analytics
Security

Rear Camera

Low Power
Small Footprint
Scalable Analytics

Radar

Scalable performance
MCU Integration
Safety

Emerging Applications

Sensor Fusion

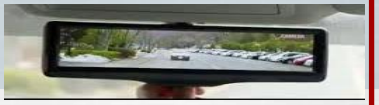
High Performance
Safety
Security

Driver Monitoring

Small Footprint
ISP Integration Scalable Analytics

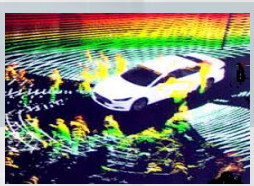
CMS / Mirror Replacement

Performance
ISP Integration
Scalable Analytics



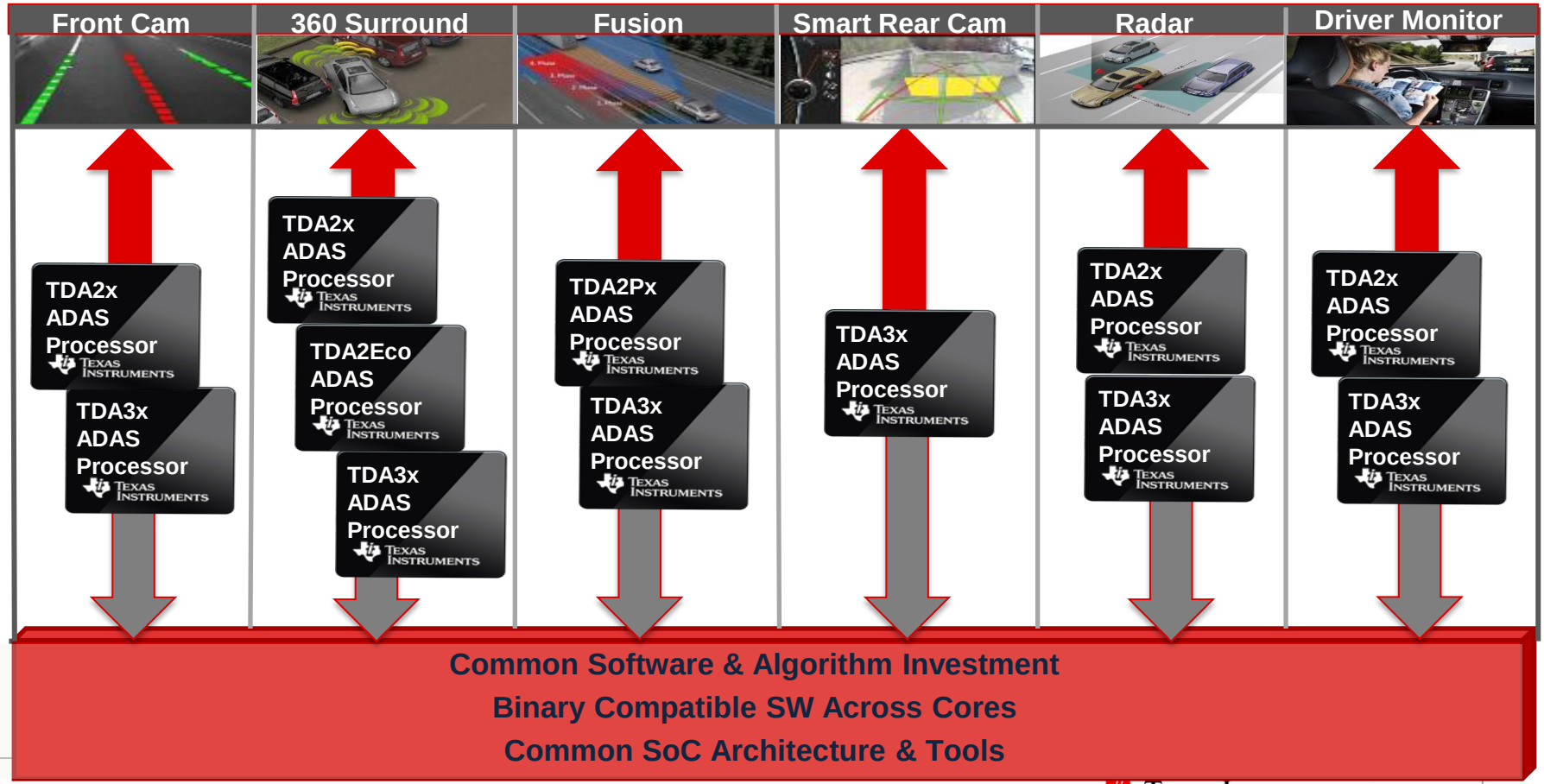
Lidar

Scalable Performance

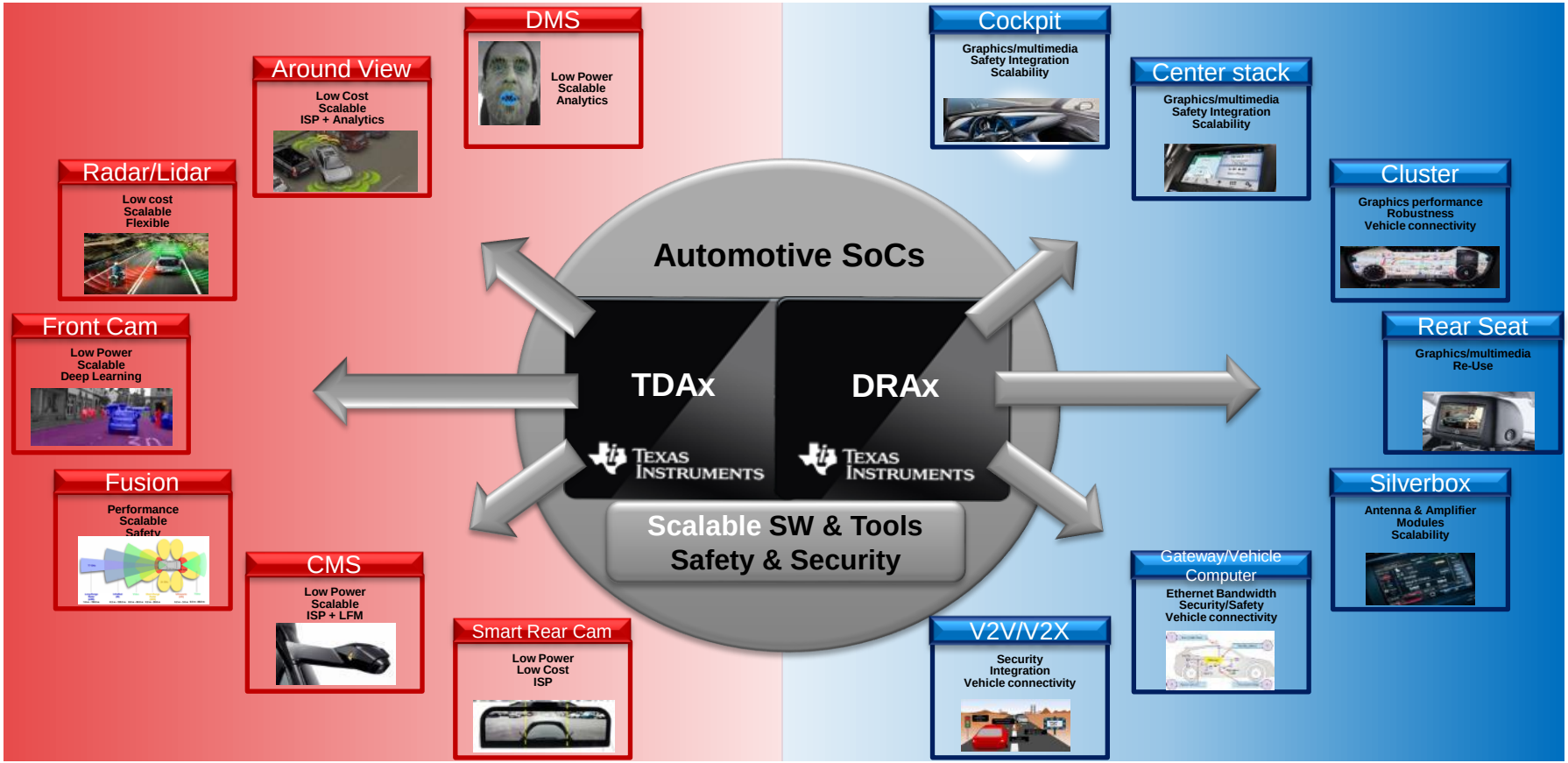


Scalable premium to entry performance solutions
Fully programmable DSP, Analytics/Video /Graphics Accelerators, and ARM cores.
Software Development Kits and Libraries provide easy portability between platforms.

TDA Family HW & SW Scalability



Infotainment and ADAS Trend



Jacinto SoC Family Demos

Your **Source** for **Inspiration**

"JACINTO 6 PLUS" DIGITAL COCKPIT

Jacinto 6

Jacinto 6 Entry Pr

Jacinto 6 Plus Processor

Texas Instruments

enables

Fully Reconfigurable Digital Cluster
- Linux-based
- 1920x720 @ 60fps

ASIL-B Certifiable
- Optional ARM Cortex-M4 based Safety RTOS

Single "Jacinto 6 Plus" Processor
Multi OS/Hypervisor

1080p 15.6" Infotainment
- Android N OS
- Latest Digital Radio and Audio features

GlobalLogic

socionext for better quality of experience

Hypervisor with GPU Sharing

CGISTUDIO

Surround View Based on DSP + ISP

"JACINTO 6 ENTRY" DIGITAL CLUSTER ASIL-B CERTIFIABLE DIGITAL CLUSTER AT A LOW COST

1920x720 at 60fps
- Performance at entry segment cost

Fast Boot Features

CAN stack on ARM Cortex M4

ASIL-B Certifiable
- Mentor Nucleus ® RTOS on ARM Cortex-M4
- Mentor Connected OS™ (Linux)

Mentor Automotive

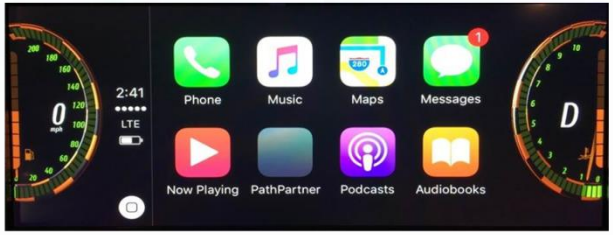
socionext for better quality of experience

CGISTUDIO

"JACINTO 6 ENTRY" DIGITAL CLUSTER + DISPLAY AUDIO

WiFi Smartphone Screen Replication

Latest Digital Radio and Audio Features



"Jacinto 6 Entry" DRA71x

Digital Cluster and Display Audio on Single 1920x720 Display

Fast Boot by Texas Instruments

AGL Platform

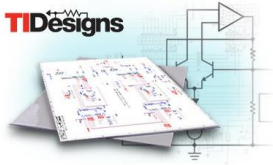
AUTOMOTIVE GRADE LINUX

PATHPARTNER

Texas Instruments

Get STARTED now

AWR1843BOOST



Get started with reference designs for TIDA-010054

WiFi Smartphone Screen Replication

Latest Digital Radio and Audio Features

Fast Boot by Texas Instruments

AGL Platform

"Jacinto 6 Entry" DRA71x

Digital Cluster and Display Audio on Single 1920x720 Display