Next-Generation Automotive Solutions on Arm-Based Microcontrollers

arm

- ✛ indie Semiconductor is a 'pure-play' automotive semiconductor company and one of the industry's fastest-growing autotech innovators. It develops the advanced, highly integrated and energy-efficient silicon solutions required for new and emerging vehicle architectures.
- ✛ >200 million chips shipped to date
- ✛ Nearly all top car OEMs use indie solutions
- ✛ indie deployed in approximately one-in-four new vehicles[i]

Accelerating Automotive Innovation

The automotive industry is experiencing an unprecedented rate of innovation as manufacturers seek to improve safety, boost engaging in-cabin user experiences, and meet consumer and regulator demand for more sustainable mobility. Addressing these challenges requires new silicon-based innovations that combine high levels of performance, compact form factors, and low levels of power consumption, while meeting the stringent requirements for automotive reliability.

Due to the combination of performance, common architecture, functional safety, advanced security, and a broad ecosystem of support, indie has put Arm® Cortex®-M CPUs at the heart of its designs.

[i] indie estimates

> "indie's solutions, powered by Arm's Cortex-M CPU technologies, meet key demands and trends across the evolving automotive industry, while fulfilling core microcontroller requirements of high performance, low power consumption and high levels of reliability."

The company is creating next-generation Arm-based SoCs to help meet the demands of future vehicles, while helping vehicle manufacturers address three key automotive megatrends:

— Driver safety and automation
— In-cabin user experience
— Electrification

Driver Safety and Automation

In-Cabin User Experience

Electrification

Accelerating Automotive Innovation

Driver safety and automation

Due to increasing regulation and global industry initiatives, there is a major imperative to incorporate safety technology into new vehicles for drivers, occupants, and road users. This requires a multitude of sensors and advanced semiconductors to gather and process data about the vehicle environment and make decisions – intelligently and safely – that are then acted upon by actuators.

indie's iND83301 Surya™ LiDAR, recognized as the 2022 'LiDAR Solution of the Year' by the AutoTech Breakthrough awards, is a compact and highly integrated SoC that significantly reduces power, component count, board space, and cost when implementing automotive coherent LiDAR systems for reliable long-range object detection. The device represents a major step forward in LiDAR architectures by reducing design complexity, improving scalability, and delivering significant improvements in power, performance, and cost. Featuring a 32-bit Arm® Cortex®-M4F processor for unrivaled efficient performance, iND83301 delivers unprecedented hardware and software integration through indie's innovative high-speed analog, mixed-signal, DSP, and software technologies.

In addition, the SoC incorporates a software-configurable receiver, transmitter, and baseband signal processor and multiple I/Os. These I/Os provide flexibility to monitor, control and synchronize LiDAR sub-systems such as optical front ends, global timing references, and scanning devices.
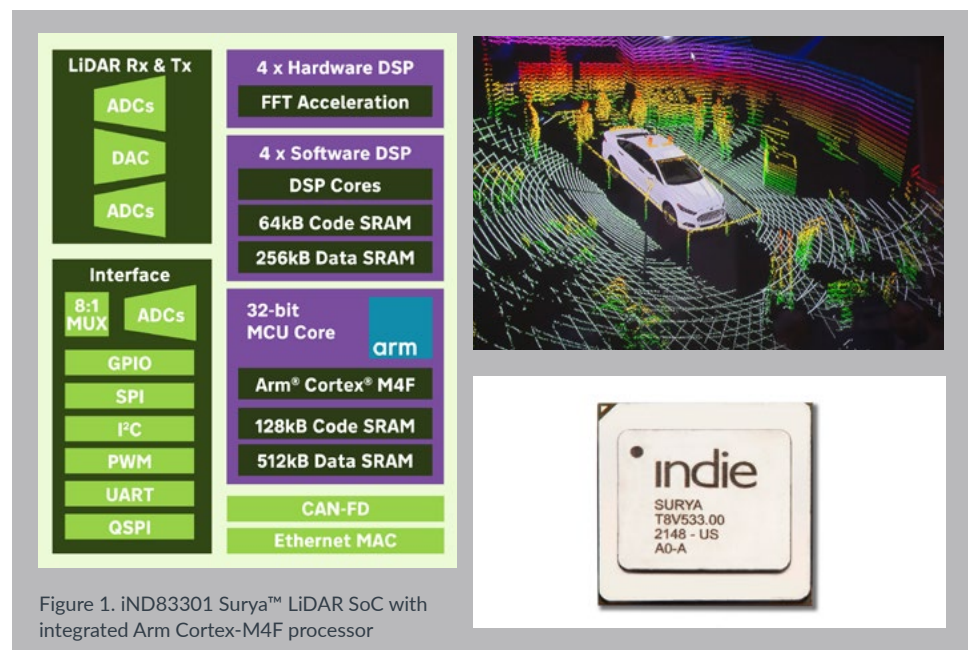

Figure 1. iND83301 Surya™ LiDAR SoC with integrated Arm Cortex-M4F processor

In-cabin user experience (UX)

The smartphone revolution has set expectations of performance, seamless integration, functionality, customization, and engaging experience that drivers and passengers now seek from their vehicles. While the in-vehicle infotainment (IVI) system and instrument cluster are often seen as the primary elements of the digital cockpit, many other applications contribute to the overall in-cabin UX. Automotive lighting and device power or charging are two great examples of applications that are part of the in-cabin UX where indie offers innovative compute solutions.

Automotive lighting

indie has developed a range of advanced Arm-based LED controllers, including the iND83211, that feature an integrated, highly efficient, 32-bit Arm Cortex-M0 processor. These solutions enable intelligent lighting systems, replacing today's discrete and legacy solutions with highly integrated microcontroller-based single-chip solutions. They allow vehicle manufacturers to create highly functional and innovative lighting, such as high-power LEDs, that deliver a positive user experience for drivers, passengers, and road users.

In addition to the Arm processor, the indie iND83211 also features 64kB of Flash memory and 16kB of SRAM. Unique to this IC is a built-in power management unit (PMU) that implements a step-down buck converter and two on-chip voltage regulators. This PMU is the key to creating a small form factor, high-power, flexible power management system capable of driving 24 LEDs or eight RGB channels.
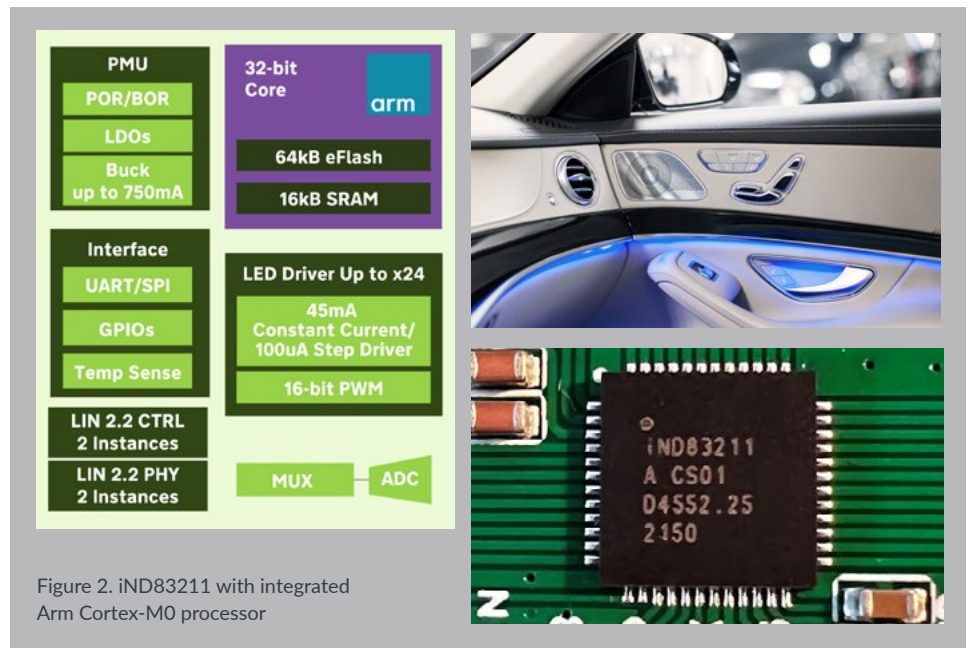
Figure 2. iND83211 with integrated
Arm Cortex-M0 processor

Power delivery and device charging

Increasing demand from consumers for charging portable devices,
including higher power devices such as tablets and laptops while on the
move, has led to a rise in the number of charging ports with higher power
ratings becoming a standard feature in cars rather than a luxury option.
Indie has developed iND87300, the automotive industry's most integrated
USB power delivery (USB-PD) programmable controller. The iND87300,
which is built on the Arm Cortex-M0 processor, reduces component count,
simplifies designs, and enhances the reliability of in-cabin vehicle charging
systems for portable devices.

The controller combines buck-boost converter, the Arm Cortex-M0
processor, Flash and SRAM memory, a 12-bit analog-to-digital converter
(ADC) and a USB-PD PHY in a single package. The on-board Arm MCU and
firmware stack supports USB-C channel configuration and PD port control,
allowing vendor-specific configurations and ensuring future flexibility with
new and emerging charging profiles and power protocols.

Figure 3. iND87300 with integrated
Arm Cortex-M0 processor

Electrification

In recent years, the general electrification of vehicles has experienced rapid adoption as manufacturers improve user control, comfort, and utility by electrifying previously mechanical or manual functions. At the same time, there is a move for more sustainable, decarbonized transportation through the electrification of vehicle drivetrains. This is creating supply chain demand for multiple semiconductor components ranging from flexible microprocessors to innovative power management devices.

indie is developing leading-edge, mixed-signal solutions that address the challenges of increased vehicle electrification. Powered by Arm's Cortex-M processors, these silicon solutions, can scale to meet the needs of a wide variety of automotive applications across the evolving architectures of electronic vehicles, including body and chassis control, advanced power management, small motor control, and battery management, to name a few.

Useful Links

- www.indiesemi.com
- iND83301 - https://indiesemi.com/solutions/ind83301-surya/
- iND83211 - https://indiesemi.com/solutions/ind83211/
- iND87300 - https://indiesemi.com/solutions/ind87300-2/
- Arm Microcontrollers for Automotive -
  https://www.arm.com/campaigns/automotive-microcontroller