Arm-based Infineon TRAVEO™ T2G Accelerating Zone Controllers for Next Generation Vehicles

March, 2022

Company snapshot

Name: **Infineon**
Vertical: **Automotive**
Size: **46,665 employees**
HQ: **Neubiberg, Germany**
Founded: **1999**

Goal

One of the megatrends in automotive electronics is the change of Electrical/Electronic (EE) architecture from single function ECUs widely distributed around the vehicle, to more capable and flexible zonal controllers that consolidate multiple of these functions into a single module. This evolution is set to be rapidly adopted by low-end through to high end luxury vehicles to enable a flexible and scalable architecture that reduces development and manufacturing costs and improves reliability.

A great example of this would be a front corner zone controller that combines the functions of light cluster, wing mirror, seat, car access, interior lighting and door controls. Such zone controllers will simplify hardware and software development, with a hierarchical structure of the functionalities. At the same time, they reduce the weight and complexity of wiring harnesses, and reduce the costs of manufacturing, installation and maintenance.

Fig1: Typical Zonal Architectures of a modern mid-sized car
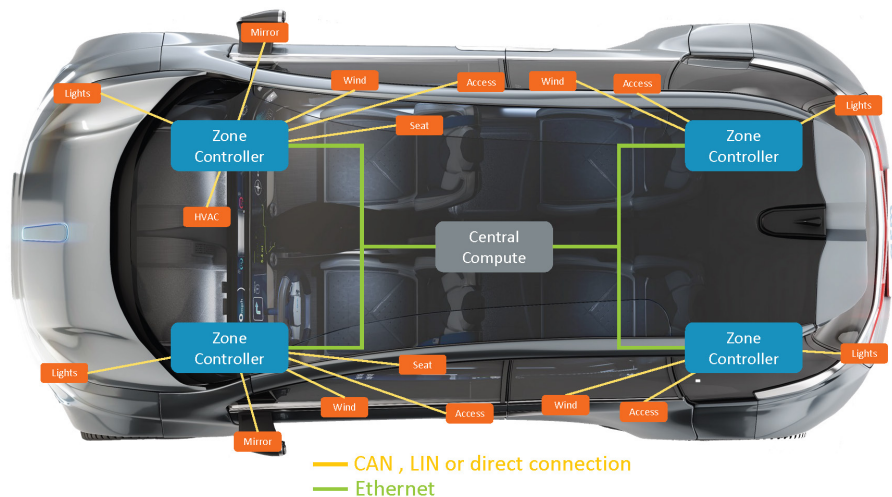
Solution

It is in applications like these that Infineon's TRAVEO™ T2G family of microcontrollers (MCUs) is becoming a popular solution. The range employs Arm Cortex-M processors, and offers performance scalability from a single Cortex-M4 right up to dual Cortex-M7. Multiple variants are available to deliver the choice of packages, memories, interfaces and features to match the different automotive application requirements, whilst retaining a high degree of software and pin compatibility. This helps automakers to be extremely agile in scaling their modules across different zones and across different vehicle models, along with providing future proofing for their investments.

Fig 2: Scale easily across performance, memory and interfaces

Arm Core	Clock	Flash	64 Pin	80 Pin	100 Pin	144 Pin	176 Pin	272 Pin	320 Pin
2 x Cortex M7	350MHz	8MB					▣	▣	▣
2 x Cortex M7	250MHz	4MB			▣	▣	▣	▣	
1 x Cortex M4	160MHz	4MB	▣	▣	▣	▣	▣		
1 x Cortex M4	160MHz	2MB	▣	▣	▣	▣	▣		
1 x Cortex M4	160MHz	1MB	▣	▣	▣	▣	▣		
1 x Cortex M4	80MHz	512KB	▣	▣	▣				

Performance →

Design Implementation

Infineon is considering extending it's family of TRAVEO™ T2G with a new quad Cortex-M7 MCU to address the increasing requirements for performance and memory.

It is not just the functions of simple distributed controllers that are getting consolidated into these zone controllers, however. Increasingly auto makers are looking to incorporate gateway functions into zone controllers as well, and so communications capability and security becomes a critical requirement for automotive MCUs. The approach adopted by Infineon for the TRAVEO™ T2G family is to have an additional Arm Cortex M0+ core dedicated to encryption as a Hardware Security Module (HSM).
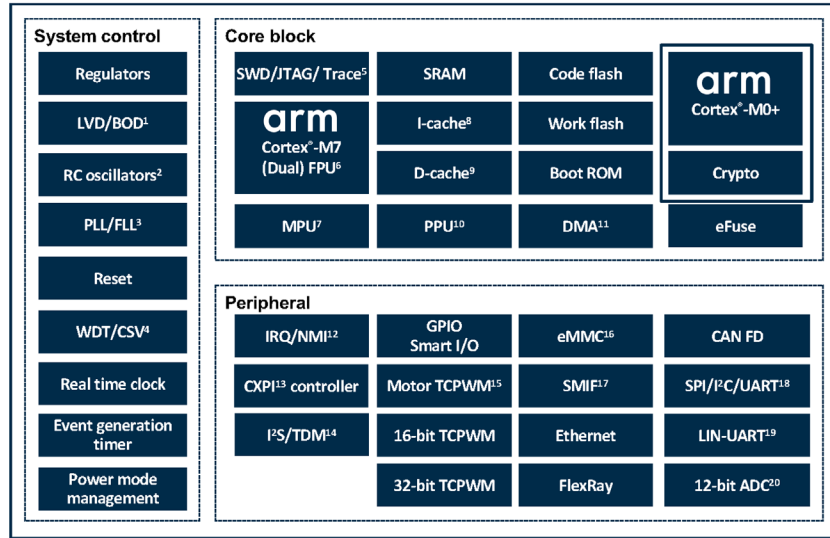
Several of the TRAVEO™ T2G products feature high-speed communication interfaces like Ethernet and FlexRay in addition to the standard Local Interconnect Network (LIN) and Controller Area Network (CAN) interfaces widely used in Automotive In-Vehicle Networking (IVN).

"Functional safety is another focus area for the auto industry, and it is rapidly becoming standard practice to demand that all electronic systems in the vehicle have functional safety capabilities."

"TRAVEO™ T2G microcontrollers are key components in current and future vehicles, based on the powerful Arm Cortex-M series in single and dual core operation it offers state-of-the-art real time performance, safety and security features."

Thomas Böhm, Senior Vice President Automotive Microcontroller at Infineon.

Fig 3: Block diagram of a TRAVEO™ T2G Automotive Microcontroller

System control
- Regulators
- LVD/BOD[1]
- RC oscillators[2]
- PLL/FLL[3]
- Reset
- WDT/CSV[4]
- Real time clock
- Event generation timer
- Power mode management

Core block

			arm Cortex®-M0+
SWD/JTAG/ Trace[5]	SRAM	Code flash	
arm Cortex®-M7 (Dual) FPU[6]	I-cache[8]	Work flash	
	D-cache[9]	Boot ROM	Crypto
MPU[7]	PPU[10]	DMA[11]	eFuse

Peripheral

IRQ/NMI[12]	GPIO Smart I/O	eMMC[16]	CAN FD
CXPI[13] controller	Motor TCPWM[15]	SMIF[17]	SPI/I²C/UART[18]
I²S/TDM[14]	16-bit TCPWM	Ethernet	LIN-UART[19]
	32-bit TCPWM	FlexRay	12-bit ADC[20]

1 Low-voltage detection/brownout detection
2 Resistor capacitor
3 Phase-locked loop/frequency-locked loop
4 Watchdog timer/clock supervisor
5 Serial wire debug/Joint test action group
6 Floating point unit
7 Memory protection unit
8 Instruction cache
9 Data cache
10 Peripheral protection unit
11 Direct memory access
12 Interrupt request/Non maskable interrut
13 Clock extension peripheral
14 Inter-IC sound/time division multiplexed
15 Timer/counter/pulse-width modulation
16 Embedded MultiMediaCard
17 Serial memory interface
18 Serial peripheral interface/Inter-integrated circuit/universal asynchronous receiver transmitter
19 Local interconnect network, Universal asynchronous receiver transmitter
20 Analog-to-digital converter

Functional safety is another focus area for the auto industry, and it is rapidly becoming standard practice to demand that all electronic systems in the vehicle have functional safety capabilities. With functions such as window and door control being bundled with interior lighting, zonal controllers need to support Functional Safety to prevent hazards for safety critical functions. A failure of interior lighting may not be a hazard, but an electric window controller failing to detect trapped fingers would be problematic. The TRAVEO™ T2G family is designed to meet ISO26262 ASIL B and offers a safety concept based on Arm CPUs ability to detect failures both inside the MCU, as well as detection of failures in connected components.

As the software defined vehicle rapidly becomes reality, zone controllers will need the ability to have seamless software and firmware updates through the life of the vehicle, both to add new features as well as for issue resolution. The TRAVEO™ T2G family includes a secure Firmware or Software Over The Air (FOTA or SOTA) update capability.

The advantage of using Arm for automotive MCUs is that OEMs and Tier1's can leverage the rich ecosystem of tools, software and services that have evolved to support the more than 200 billion Arm-based chips produced to date. OEMs can leverage a large pool of talented software and hardware developers who are already familiar with the Arm architecture.

Useful Links

✛ 32-bit TRAVEO™ T2G Arm® Cortex® Microcontroller

✛ Infineon — Dependability and Zonal Architectures

✛ Arm — Cortex-M4 and Arm Cortex-M7

✛ Aptiv — Zone Controllers Build Bridge to Tomorrow's Technology

✛ Visteon — Zonal EE Architecture