

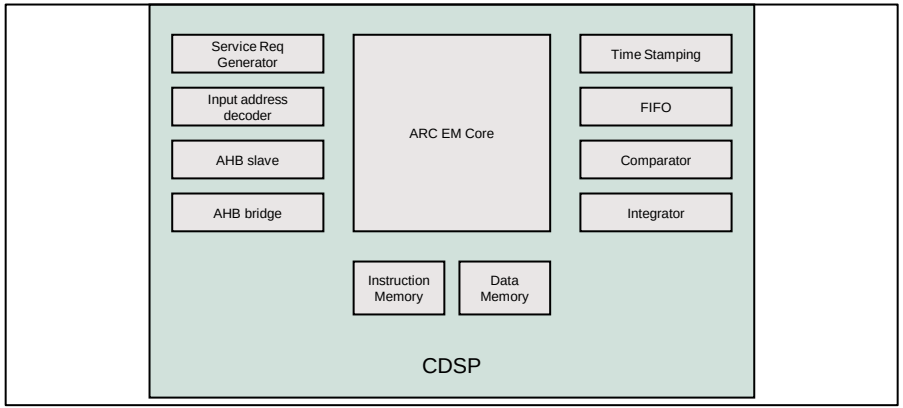
CDSP
Converter Digital Signal Processor

AURIX™ TC4xx Microcontroller

V1.0.0 2024-09

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CDSP
Converter Digital Signal Processor



Highlights

- ARC EM5D based Converter DSP solution (CDSP) to meet the high-performance market requirements for classical power train and xEV applications
- 3 Software packages are offered to meet ISO26262 ED2 (ASIL D), Automotive SPICE 3.1 and ISO21434 process Compliance
- Up to 18 CDSP cores having in total 5202 DMIPS of signal processing power.

Key Features

Flexible filter chain and full configurability

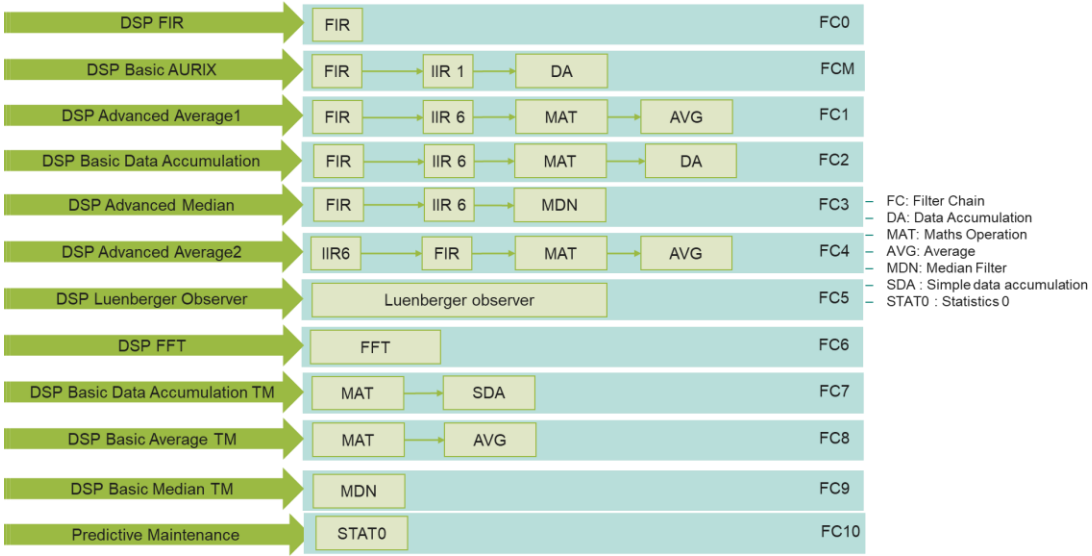
Arbitrary results connection

Customer Benefits

- More MIPS on system level
- Can be used as control element e.g. PID controller for fast control loops > 200 kHz
- Replaces external DSPs used in the customer system for BoM cost reduction

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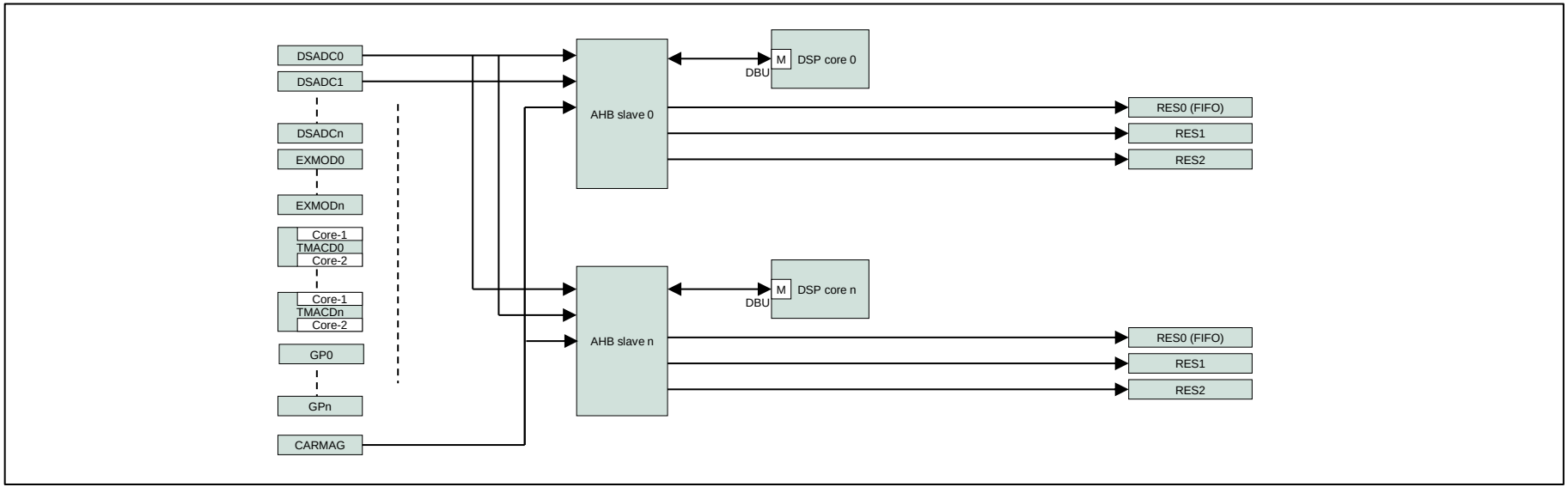
CDSP
Flexible filter chain and full configurability



- **DSP Basic AURIX** filter chain contains all the filter configurations already part of the AURIX™ TC3xx Enhanced Delta-Sigma Analog-to-Digital Converter (EDSADC)
- A lot of additional filter chains to support further application cases, for example Knock detection, Lünberger Observer
- The filter coefficient is fully configurable without re-compiling the CDSP software

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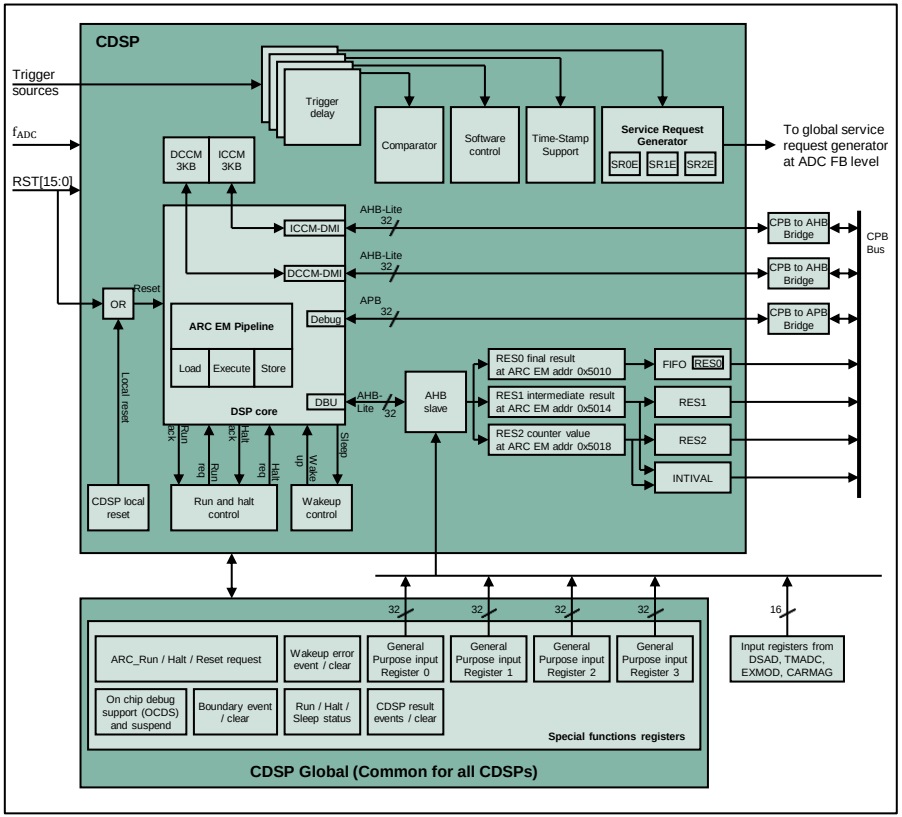
CDSP
Arbitrary results connection



- Input of CDSP can be ADC results from the Delta-Sigma Analog-to-Digital Converter (DSADC), the External Modulator (EXMOD),the Time-Multiplexed Analog-to-Digital Converter (TMADC), as well as General Purpose Register results provided by e.g. DMA
- Flexible connection: one ADC result can be connected to multiple CDSP cores, or multiple ADC results can be connected to a single CDSP core
- Output supports a FIFO buffer

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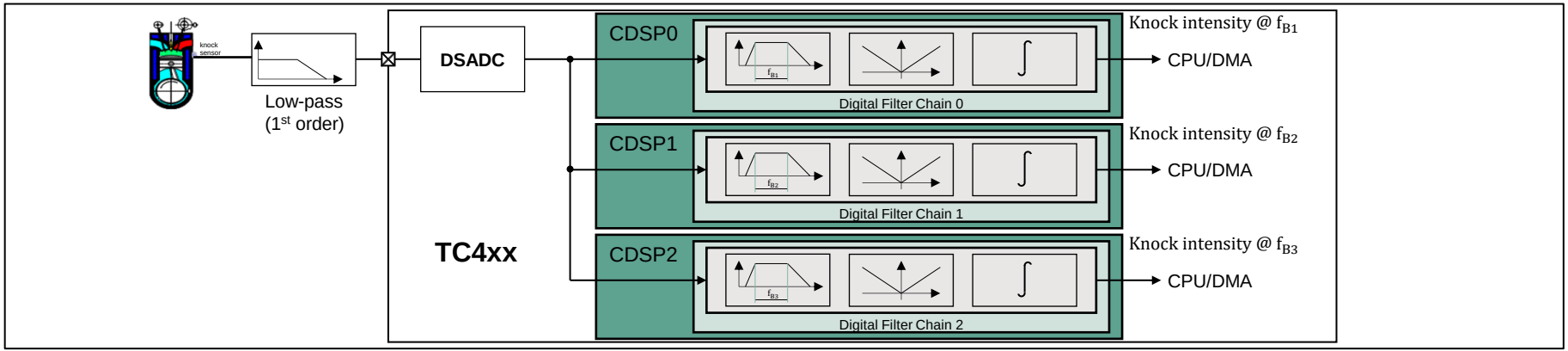
CDSP
System integration



- CDSP core is a 32-bit architecture with a highly efficient three-stage pipeline, which is connected to DSADC, TMADC, Carrier Modulator (CARMAG) and General Purpose registers for processing results coming from different sources and using different types of filter chains
- CDSP has a service request generator which can trigger interrupts on different event like when the timestamp information or the results are available

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Application example
Knock Detection



Overview

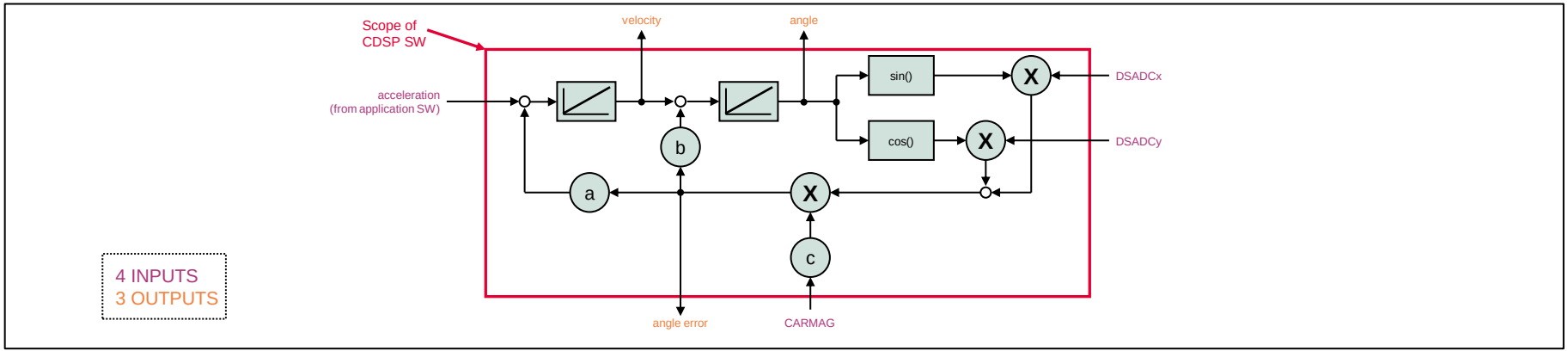
- Output voltage of knocking sensor is transferred by an internal DS-modulator to a bit-stream signal
- Based on the digital filter chain internal rectification and integrator functionality, the knock intensity for every bandwidth (fB1, fB2, fB3) is calculated

Advantages

- No digital Filter Processing with TriCore™ necessary
- Each bandwidth can be configured flexibly

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Application example
Lünberger Observer



Overview

- Having near-perfect feedback signals from sensors is one of the main principles used in control theory, but most of the time these come with a high cost
- By using such an observer, information coming form the sensors can be combined with knowledge of the system, therefore reducing the system costs

Advantages

- No tracking loop using TriCore™
- Good noise supression for high EMC robustness
- Good performance also for low resolver pole pairs count
- 625 kHz result rate for fast setting time
- Supports OPP (optimized pulse pattern) control for advanced xEV applications

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AURIX_3_Analog-to-Digital_Converter

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