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Safe and Rapid with M32C

Beside their large MCU families with many dedicated MOST, CAN and LIN products, like R8C, M16C, M32C, M32R/E, H8 & SH, Renesas will have the first FlexRay MCU ready in 2005.

Renesas uses the FlexRay IP from Robert Bosch GmbH. The first FlexRay MCU is not just any MCU, it is an evolution of the famous M16C/M32C family. The automotive variation with up to four CAN channels and integrated E-Ray FlexRay IP-Module is called M32C/100F. This new MCU expands the M32C Family product portfolio in the upper segment. Furthermore it is planned to equip the high-performance 32-bit-RISC controller M32R/E and SH2-A with FlexRay as well.

The early phase of FlexRay projects are extensive and demand a certain amount of resources. To have an entire FlexRay environment in time, Renesas Technology will be able to provide the first M32C/FlexRay evaluation device already by end of this year.

Strong M32C
To be prepared for the increasing demand of calculation power for future high-speed

processing applications M32C/100F has a new enhanced 32-Bit CISC CPU. The core can be feed with an internal operating frequency of 100MHz. The average instruction length is in the range of 2-4 cycles. Additionally performance enhancement can be yield by incorporation of the multiplier and the floating-point unit. Powerful features for software improvement like two direct memory access controller (DMAC) allow data to be transferred without using the CPU. Memory-to-memory transfer, immediate data transfer, calculation- and register transfer triggered by hardware and software events are possible to execute. Four different clock generating circuits are implemented to find the perfect compromise between calculation speed and power consumption. The M32C/100F can be driven by the main clock oscillation circuit, sub clock oscillation circuit, on-chip oscillator and by using the PLL frequency synthesizer. M32C/100F will be available in 100- and 144-pin plastic molded LQFP packages. Different operating modes for the 512kB on-chip flash memory can be selected from CPU

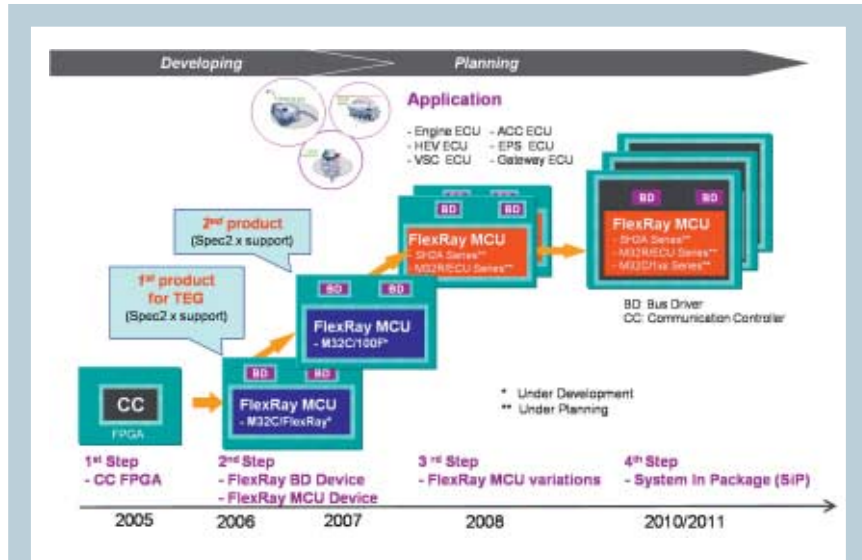


Figure 1: FlexRay MCU Roadmap

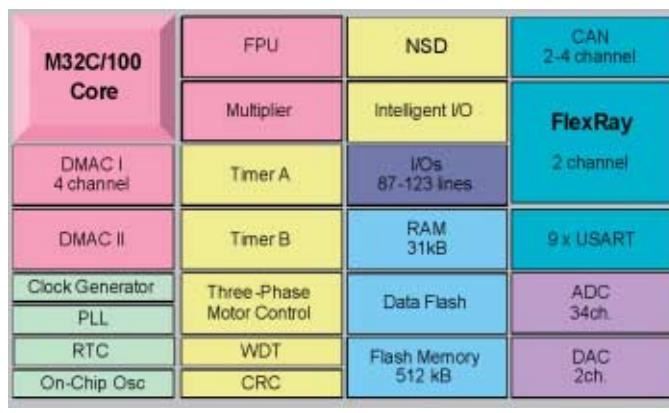


Figure 2: M32C/100F outline

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rewrite mode, standard serial I/O mode and parallel I/O mode. A data flash memory area of 2x4kB with ten-times higher characteristic than the program memory is available for data and parameter storage.

CAN and LIN support

Beyond FlexRay, Renesas Technology's self-containing automotive network solutions go on by supporting Controller Area Network (CAN) and Local Interconnect Network (LIN). CAN belong to the standard product portfolio of Renesas network solutions and can be used by the two to four channels of M32C/100F. In this context Renesas intends to bring a new upgraded CAN module with 32 to 64 message buffers to the market. Seven configurable USART interfaces for asynchronous and synchronous transmission suitable for LIN are available as well. For LIN communication a frame based hardware IP with optimized features to minimize software load is planned. A dedicated buffer that enables consecutive LIN data transfer, selectable sync break/delimiter and others is therefore considered.

Compatible Peripherals and abundant Timer-Units

To enable software compatibility many peripherals of the well-known M32C family will be implemented in the new M32C/100F FlexRay device. Starting with the 123 programmable I/O ports, 34 channel A/D converter

and two channels of D/A converter can be recognized. From special interest for x-by-wire and EPS systems is the capability to drive three-phase motors. A three-phase-timer unit can be configured with the multi-functional general purpose timer A/B. The intelligent I/O group is intended for complex output signal generation. It is a multifunctional I/O port for time measurement and waveform generating. The intelligent I/O consists in total of two groups. Each group has a 16-bit base timer for free-running operation and eight 16-bit shift registers for time measurement and waveform generation.

Reliable EMC & EMI

Due to many electromagnetic effects from different electronic components, like bus drivers, switching-circuits and antennas it is obvious that only MCUs with good noise immunity and a low emission noise will survive. Especially high-speed networks, like FlexRay with bandwidth up to 10Mbit/s, are very sensitive for external disturbance. Reliability, synchronization and safe start-up are only a few points that cause annoyance in this context. With it sophisticated EMC performance, the M32C is one of the best products to build up a safety relevant FlexRay network around.

Innovative Debugger

For the higher frequency range Renesas Technology developed a new debug concept. The serial

FlexRay Tools and Services



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FlexRay CCM

- Versatile PC interface for FlexRay and CAN
- Two FlexRay and two CAN channels
- PC connection via Ethernet
- Powerful application interface

Multibus Analyser

- Recording, monitoring, interpretation and transmission of FlexRay and CAN messages
- Open programming interface and Scripting Host

Services

- Development of hardware and software
- Consultation



Leibnizstr. 15 · D-88250 Weingarten
Tel.: +49-(0)7 51 / 5 61 46-0
Fax: +49-(0)7 51 / 5 61 46-29
Internet: www.ixxat.de

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H/W Architecture Spec.	Define ECUs and connect to networks and channels
Function Spec.	Define functions and map to ECUs
TDMA Spec.	Define FlexRay bus timing and TDMA pattern
Scheduling	Map signals or frames to communication slots
FIBEX Export	Export network design data
FIBEX Merge & Import	Import network design & merge with existing design data
ECU H/W Refinement	Define MCUs and CCs
ECU S/W Refinement	Define tasks, map tasks to MCUs, define intertask communication
Communication Task Planning	Plan timing of communication tasks
Buffer Mapping	Map signals/frames to buffers
Driver Configuration	Configure drivers and configuration registers

Figure 3: FlexRay Workflow

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debugger NSD is a single-wire debugger for high frequencies. No special evaluation chip and packaging is necessary. Customers will have a very efficient on-chip-debug without losing function pins. Only one mode pin and GND is used. Evaluation in realistic operating conditions enables users to debug in conditions similar to the final application. The full debug functionality, as real-time emulation at highest MCU operating frequency, trace functions are built in.

FlexRay Workflow

The process of development for FlexRay systems varies from conventional work flows. One main area is the global network management, the other bundles the software and hardware requirements of a local node. This must be distinguished again into communication driver and application software. It is very often called system-workflow and ECU-workflow. The major concern now for developers is not only to deliver a solution for the application itself and the bus-system, but to also handle the architecture and system specification together with the message scheduling. Modern software tools like the DECOMSYS::DESIGNER PRO: make it manageable. First the carmakers create the scheduling with TDMA and assign the message slots to the network partners. After the global network parameters and communication schedules are defined they can be delivered via a design data file to the suppliers. The suppliers import it into their development environment. Then they can go on with the local driver configuration and development. The need of an overall development environment is indispensable.

Development Environment

Software and hardware tool environment for Renesas FlexRay solutions is supported by DECOMSYS. The FlexRay development environment gives a simplified overview of the process. The user can develop his application code, whereas the communication part is given in unaffected, fixed files and individually, generated ones. For the configuration of a FlexRay network the DECOMSYS::DESIGNER PRO provides a system

generator and an ECU generator. Application and communication software elements are compiled and linked together. For Renesas FlexRay solutions compiler from IAR Embedded Systems is recommended. The output file can then be downloaded to the Node<RENESAS> hardware. Node<RENESAS> comprises not only a solution for FlexRay. It contains high-speed CAN transceiver, USART with LIN transceiver and analog IOs as well as digital IOs; all are easy accessible via plugs.

The basic conditions of a FlexRay bus with the global network parameters are provided in a so-called vehicle network data base. Based on these parameters the FlexRay cluster can be set up with the DECOMSYS::DESIGNER PRO. The design of the FlexRay cluster itself delivers kind of description file. Among other things the description file is harnessed for the DECOMSYS::BUSDOCTOR the powerful monitoring tool for analyzing the bus. The loop is closed.

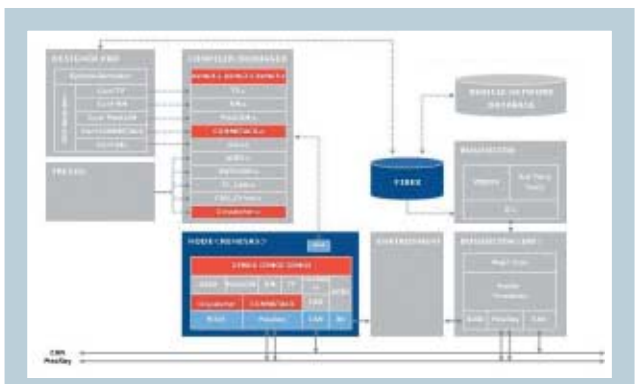


Figure 4: FlexRay Development Environment

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Summary

Accepted as a leading edge supplier to the automotive industry, Renesas Technology's semiconductors are being used extensively in automobiles - from bodies to engines. Renesas is committed to provide and support complete FlexRay system solutions enabling future innovation in the automotive area. This includes integrated FlexRay controllers, bus drivers and development platforms giving customers maximum flexibility to build and test their applications. Additionally, by using the FlexRay solutions of Renesas, customers can be prepared for the next step of modern automotive requirements.

References

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Stefan Strakeljahn is Senior System Engineer in the Automotive Business Unit at Renesas Technology Europe GmbH.