



NODE<V850> evaluation board with NEC V850E/IA1 Phoenix

NEC Electronics' Time Triggered Solutions

FlexRay application fields are no longer limited to steer- or brake-by-wire. Car makers are about to deploy some groundbreaking new chassis control features in a FlexRay network. This unexpected use of FlexRay comes well before steer- or brake-by-wire systems will be ready for production vehicles.

NEC Electronics' long history in time-triggered communication protocols began with work on a global time system in distributed networks and continued with the ISO standardization of TTCAN. As an associate member of the FlexRay consortium since 2003, NEC Electronics is now turning FlexRay theory into reality with the first silicon implementation called Phoenix-FS. This powerful 32-bit RISC microcontroller is particularly suited for high-performance chassis applications in the automotive area. Phoenix-FS has a peripheral set compatible to Phoenix-F, providing an easy upgrade path from Phoenix-F and offering a scalable solution.

It is optimized for inverter control applications requiring control of up to two 3-phase motors simultaneously, for example in electronic power steering, hybrid electric vehicles and chassis dynamics control. Equipped with an embedded FlexRay controller based on the Bosch E-Ray IP, Phoenix-FS is ready for advanced network architectures and future x-by-wire applications. On-board safety features

like ECC on flash and parity on RAM meet highest safety requirements. The next step to completing NEC Electronics' gateway roadmap is a high-end gateway microcontroller. This 32-bit RISC-microcontroller called CarGate-X will feature up to 4 x CAN, FlexRay and an integrated Media-LB interface for MOST.

E-Ray IP features

- Protocol V2.1
- Two communication channels
- Data rates up to 10 Mbps on each channel
- Configurable message buffers number and sizes:
 - up to 128 message buffers and up to 254-byte data field
- One configurable receive FIFO
- Filtering: frame ID, channel ID, and cycle counter
- Host access to message buffers via I/O buffer
- Shadow I/O buffer for optimized CPU access
- Network management support
- Interrupts for error, status and timer

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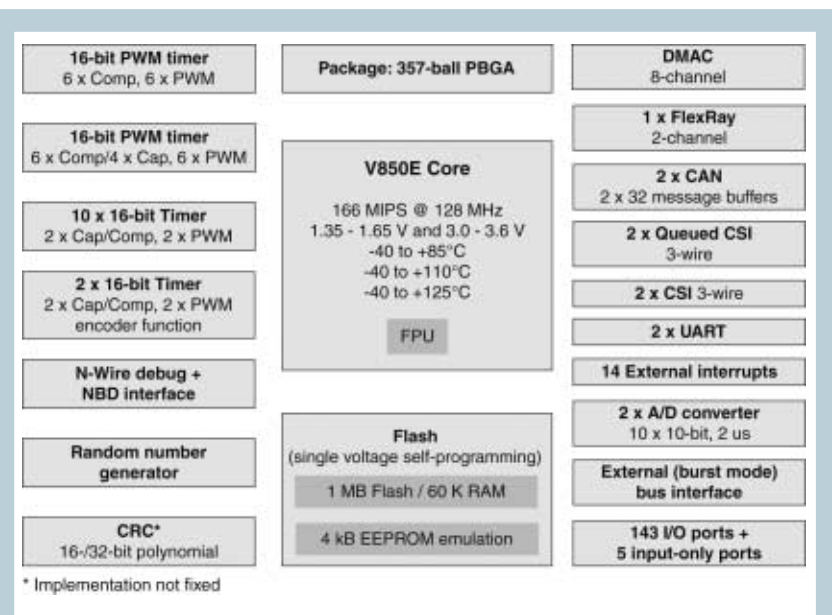


Figure 1: Phoenix-FS features

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Adapting a new network architecture seamlessly to the existing environment in a car is probably one of the biggest challenges for a developer. NEC Electronics takes a two-step approach to supporting this tough task. The aim is to provide solutions based on the latest FlexRay specification. In the first step, development starts with a flexible FPGA evaluation platform for tool chain development, first ECU customer prototyping and conformance/interoperability tests. The second step is the production of embedded solutions, such as Phoenix-FS, for dedicated applications. NEC Electronics currently offers two different evaluation platforms developed in close cooperation with the companies K2L, DECOMSYS and YDC. The NODE<V850> allows

engineers to evaluate basic FlexRay features and prepare their applications for forthcoming NEC devices with embedded FlexRay. The MoCCa Vario II is for advanced gateway applications and includes the physical layers for Ethernet, MOST and USB 2.0 in addition to FlexRay and CAN.

The NODE<V850> was designed using an NEC V850 CPU and FlexRay driver and is bundled with applications that can be modified to suit requirements. The NODE<V850> is equipped with NEC's V850E/IA1 Phoenix CPU and an FPGA (Altera Cyclone II) on a sub-board to ease flexibility, containing the Bosch E-Ray FlexRay controller. Besides two FlexRay channels, the board offers one high-speed CAN and two RS232 interfaces, 512 Kbytes SRAM and 2 Mbytes Flash ROM. Additional debug capability is supplied by more than 130 debug pins and the optional use of in-circuit emulators. Two freely programmable 7-segment LEDs, 8 DIP switches, and 12 LEDs further increase the flexibility

and applicability of this evaluation board.

The MoCCa Vario II evaluation board has NEC's V850E/PH2 Phoenix-F CPU mounted on a CPU sub-board and provides 512 Kbytes of internal Flash and 512 Kbytes of external RAM and two Altera Cyclone II FPGAs also mounted on sub-boards. This is an excellent solution with an extremely high interchangeability level for the rapid design of high-quality multi-bus gateways.

This set-up is used to create automotive gateways between multiple physical buses and different logical protocols and it provides an easy CPU upgrade, e.g., to Phoenix-FS. Besides two FlexRay channels, the board has up to 6 high-speed CANs, one MOST via MLB interface, one Ethernet

(100 Mbps), one serial UART with a maximum speed of 115.2 kbps and a USB 2.0 interface. An N-wire interface provides a comfortable and economical debugging solution. This two-step approach is tuned to the FlexRay consortium's schedules for specification and conformance tests, which have been planned to ensure a safe and matu-



Figure 2: MoCCa Vario II evaluation board with NEC 850E/PH2 Phoenix-F

re FlexRay introduction. To complete the support infrastructure, NEC Electronics is working with third parties on the FlexRay development tool chain, bus analyzer tools, FlexRay driver, OSEKtime implementations, and conformance and interoperability tests. To sum up: NEC Electronics provides a system solution based on one of the most popular 32-bit CPU cores and incorporating a mature and conformance-tested FlexRay module with fully-fledged features and a comprehensive tool set



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