

Fault-tolerant ECU platform including an in-vehicle Ethernet controller

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An electronic control unit (ECU) is a key component in implementing automotive functionalities such as braking systems, power steering systems, as well as engine control systems. A single-chip ECU platform exhibiting much stronger fault-tolerance than conventional structures is implemented. A block diagram and a die photo of the single-chip ECU platform is shown in Fig. 1. The Core-A embedded processor [1] with additional fault-tolerant techniques is employed as a main controller. Compared to the conventional controllers, the proposed fault-tolerant Core-A processor provides much stronger fault-tolerance because a double-error correcting (DEC) BCH code is employed. A low-complexity search-less DEC BCH decoder [2] is implemented to correct bit errors of the memory system while the register file inside the processor is protected by the single-error correcting Hamming code. In addition, a 100BASE-TX Ethernet controller is included to provide a new solution of in-vehicle control network reducing the wiring harness in vehicles. Lastly, there are various kinds of peripheral interfaces such as inter-integrated circuits (I2C) and 4-channel serial peripheral interface (SPI). The ECU platform is fabricated in a 65nm CMOS process. The platform occupying area of 0.80mm² operates at a maximum operating frequency of 208MHz.

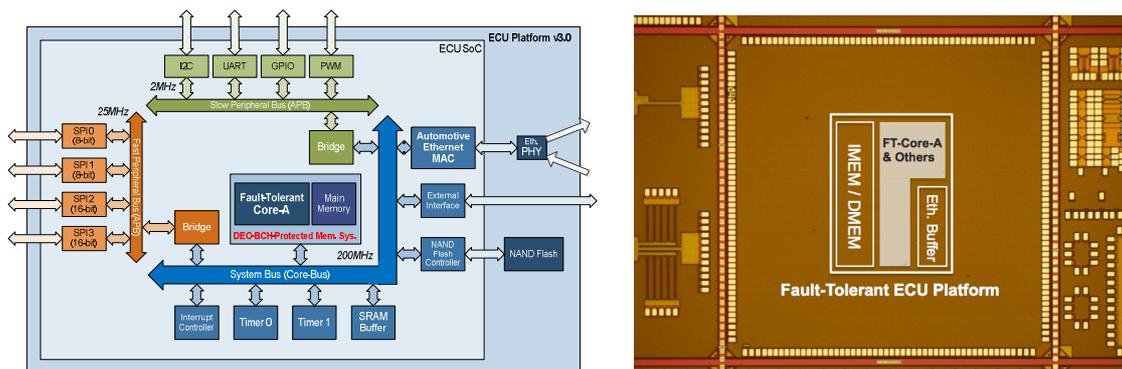


Fig 1. A block diagram and a chip die photo of the single-chip ECU platform

[1] J.-H. Kim *et al.*, "Design of high-performance 32-bit embedded processor," in *Proc. IEEE Int. SoC Design Conf.*, Nov. 2008, pp. III-54 - III-55.

[2] I. Yoo and I.-C. Park, "A search-less DEC BCH decoder for low-complexity fault-tolerant systems," in *Proc. IEEE Workshop Signal Process. Syst.*, Oct. 2014, pp. 44-49.

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