Partial networking reduces CO₂ emissions

The automotive industry is under pressure. The CO₂ emissions generated by cars shall be reduced. In Europe, Euro 6 regulations will replace Euro 5 in 2014, and the average CO₂ emissions limit will be 95 g/km by 2020. Chinese 4 standards, similar to Euro 4, came into force in China in 2011 and the city of Beijing is planning to adopt Chinese 5. In the USA, Corporate Average Fuel Economy (CAFE) requirements for passenger cars will increase from 30.6 to 37.5 mpg by 2016 and 55.2 mpg by 2025. Transceivers will help carmakers respond to changing new-car legislation in major markets worldwide, aiming to save fuel and reduce emissions.

The first silicon...
Although the partial wake-up standard is under development, the first chipmakers have announced CAN transceiver chips with this functionality. Elmos (Germany) was the first one. The last year announced E3313 transceiver realizes CAN partial network operation. The partial network mode makes it possible to individually activate ECUs whose permanent operation is not required. If, for example, an ECU in a vehicle is designed for partial network operation, CO₂ emission can be reduced by up to approximately 0.5 g/km. The chip has been already pre-tested in a vehicle by a German carmaker. The IC represents an HS-CAN transceiver according to ISO 11898-6, featuring remote wake-up by means of an individually configurable wake-up frame (WUF), in addition to the usual wake-up sources. If the transceiver is directly battery-supplied in partial network operation, as is common practice in deep sleep mode today, all other components of the ECU can be de-activated. The partial network transceiver monitors the bus traffic, analyses it down to the bit level, and responds to the control device’s individual wake-up message. In this partial network mode, the power input of the control device is below 500 µA.

One application example is the wind ECU. If the function of the ECU is selected, the device is activated selectively for the period of time required for operation. Other candidates for partial wake-up are the trailer, door, air-conditioning, rear-view camera, auxiliary heating, and power steering ECU.

The task of filing and reading out the individual wake-up message, configuring parameters and controlling state transitions are facilitated by a SPI compatible interface (Serial Peripheral Interface) to the ECU’s micro-controller. The transceiver chip guarantees that both partial network transceivers and conventional high-speed CAN transceivers according to ISO 11898-6 can be operated together in one network (interoperability). Samples of the chip are available.

...the second partial networking ICs...
NXP has launched its ISO 11898-6 compliant transceiver end of this summer. The TJA1145 is the response to government call around the world for a reduction in CO₂ emissions from vehicles. Carmakers are increasingly focused on finding ways to produce more environmentally friendly vehicles. As such, car manufacturers are now pushing for CAN partial networking to become an industry standard via ISO and Autobus.

The stand-alone TJA1145 CAN transceiver and system basis chip UJA1168 – the world’s first hybrid integrated solution to support CAN Partial Networking – gives design engineers precision control over a vehicle’s bus communication networks. By activating those ECUs that are currently not needed, engineers are able to significantly reduce vehicle fuel consumption and CO₂ emissions without sacrificing performance or consumer experience.

In current in-vehicle networking architectures, all ECUs are always active and consuming power when the vehicle is in use. This is the case even when the applications they control are not continuously required, such as window lifter, adjusting the mirrors, etc. CAN partial networking changes this model by activating only those ECUs that are functionally required, while the other ECUs remain in a low-power mode until needed. At a major international automotive conference held in Ludwigsburg (Germany) in June 2011, Audi, BMW, Daimler, Porsche, and Volkswagen made a public announcement in favor of establishing new industry standards. Ricky Hudi from Audi, appealed to all car manufacturers to actively support the rapid introduction of CAN partial networking architectures and solutions. "CAN Partial Networking is an area where we see great potential for energy savings," he said. "In addition, intelligent wake-up concepts improve the lifetime of ECUs and increase the operating reach of electrical vehicles. Audi and Volkswagen corporations have therefore decided to introduce partial networking into the next generation of our models. Audi estimates a mid-term reduction potential on CO₂ emissions of about 2.0 g/km and fuel savings of 0.11 liter per 100 km, when using CAN.

The TJA1145 and UJA1168 are next generation networking solutions, which combine analogue circuitry and high- and ultra high-speed digital circuits. The TJA1145 is a high-speed CAN transceiver, while UJA1168 is a system basis chip with 5V/130 mA micro-controller supply. Both support CAN partial networking by enabling "Selective wake-up" and "Selective sleep" functionality. Both chips come with a bootloader based on the HI95714 package. For backwards compatibility reasons, the TJA1145 is also available in a SO14 package. Engineering samples for TJA1145 and UJA1168 are available with volume shipping in 2012.

...and the third chip claiming ISO 11898-6 compatibility...
ST Microelectronics (Franco) has announced the U4W377X/J, which will support partial networking functionality as described in ISO 11898-6. " Authorities worldwide are setting progressively tougher environmental performance targets for new cars, and car manufacturers must maximise efficiency throughout the vehicle in order to comply," said Mister Martin from ST’s Automotive Electronics Division. "Integrating two partial networking providers ahead of the trend around 0.5 g/km CO₂ is the drive to meet the new standards.

The chip is housed in a PowerSSO-36 package and is scheduled for volume production in H1 2012. It is a member of power management system ICs. By integrating both High-Speed CAN (ISO 11898-6) and LIN physical layers, it provides all the features to connect ECUs to car body applications to the in-vehicle networks. Its features are tailored to particular use cases such as on-air control modules and door control units, as well as seat modules, trunk and trailer modules, and rear-view modules. Unlike general CAN transceivers or system-level chips currently on the market, the announced transceiver is able to monitor the CAN bus lines autonomously, without the module’s main processor being active. It activates the module only when a correctly addressed wake-up signal is detected. By allowing parts of the CAN network to be de-activated in this way, the transceiver contributes to reduce overall electrical energy consumption.

Advanced failsafe functionality is an additional feature, which improves the sustainability and reliability of ICs. Built-in features such as supervision of the micro controller, supply voltages and temperatures provide protection against causes of failure. In addition, peripheral functions such as high-side and low-side gate drivers, operational amplifiers and voltage regulators reduce the number of external components and lowers overall system cost.