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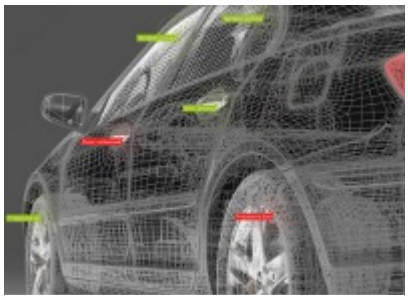
The Customer Magazine

Applications & Cases



SAW components for automotive electronics December 2010

SAW filters and resonators get smaller

TDK-EPC now offers highly miniaturized EPCOS SAW filters qualified to AEC-Q200 Grade 1. Their footprint measures only 2.5 x 2.0 mm² – almost 45 percent smaller than predecessor versions. This creates new design opportunities for automotive electronics.

Quartz SAW filters and SAW resonators in new 2520 packages are particularly well suited for applications such as highly integrated bidirectional remote control keys for motor vehicles. The design requirements and several supplementary functions necessitate miniaturization of all the components. The new 2520 packages also satisfy the wish for ever lower profile components: their insertion height is only 0.86 mm.

Bidirectional remote control link

The bidirectional link between key and vehicle was previously usable only at close range, such as via XYZ transponder coils for keyless entry. In the future, the vehicle key will also be able to exchange significantly more data with the vehicle over longer distances. This will permit attractive new functions for the motorist, such as a display of the locking status of the doors, sliding roof and trunk on the key.

As these innovative remote control keys usually also contain data memories such as a USB stick, they can store data such as error messages which can be transferred to a PC. Such data permit faster and more precise diagnosis in the workshop of the type and extent of any required service work, which can then be discussed on the spot with the customer.

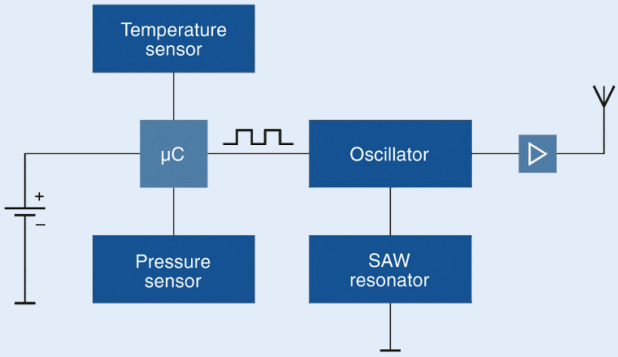
Popular functions are the regulation of the interior temperature and ventilation of the cabin before entering the vehicle. Although the use of air conditioning may require the engine to be started, it can also be triggered from a distance of up to 500 m. Execution of the activated function is confirmed via an LED or the key display. In electric vehicles, a display of the remaining range on the key is also conceivable.

Tire pressure monitoring

Since the end of 2007, it has been mandatory in the USA for all passenger cars to be equipped with a tire pressure monitoring system (TPMS). In the EU, this obligation will go into effect for new models from 2012 and will be binding on all models from 2014. Development engineers are thus faced with the task of implementing a remote control transmission system that minimizes the load on the TPMS battery. As a result, the latter can be made very small, and a changeover to systems without batteries will even be possible in future.

The operating life of the tire pressure monitoring systems specified by the OEMs is between 7 and 10 years at a specified operating temperature of -40 to +125 °C. The core of a TPMS transmitter is an ASIC, which can be operated at no more than 1.5 V and only allows transmission to take place when the tire pressure actually changes, such as when the vehicle is stationary (sleep mode). A Colpitts oscillator (Figure 1) stabilized with a SAW resonator is a suitable transmitter in this case. It consumes little power and has an extremely rugged mechanical structure, because it dispenses with a quartz crystal, unlike a PLL transmitter. Space is also at a premium in a TPMS transmitter, so that components in the highly compact 2520 packages are a suitable option given the low bandwidth tolerance of ±25 kHz.

Figure 1: Block diagram of a TPMS



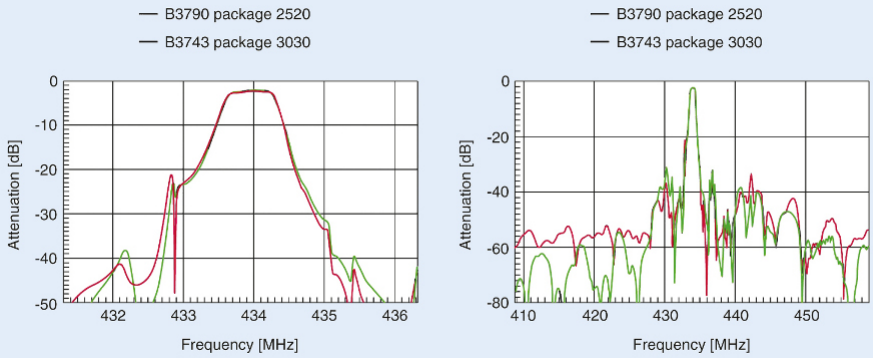
The robust ceramic package enables the applications of SAW resonators inside the tire.

Availability and technology of the new 2520 packages

The rigid structure of the 2520 packages ensures the required frequency stability. The 6-pin DCC6F case is used for filters and the 4-pin DCC4B case for resonators. The latter stands out with its additional castellations, which improve the connection to the PCB and simplify the optical quality control – especially important in applications such as TPMS that are exposed to very high g-forces.

In principle, all existing 3030 quartz filters and resonators can also be implemented in the new 2520 packages. The relevant specifications diverge only minimally (Figure 2). For the start of the series, three filters were prepared for the frequently used ISM frequencies of 315, 434, and 868 MHz. A 315-MHz resonator is also available with an improved narrow (±25 kHz) production tolerance for the smaller 2520 package size (see table). The DCC4A was introduced as a third package variant: it is designed for broadband filters with a center frequency (f_c) of >1.5 GHz and thus for applications such as GPS (f_c = 1.575 GHz). It is consequently the smallest SAW-GPS filter with AEC-Q200 Grade 1 qualification worldwide.

Figure 2: Comparison of the B3743 and B3790 filters at 433.92 MHz



The electrical performance of filter components in 2520 and 3030 packages is nearly identical

Table: Available SAW filters and resonators in the 2520 package

Type	Center frequency [MHz]	Package size/type	Usable bandwidth [MHz]	Typical insertion attenuation [dB]
B3961	315.00	2520 (DCC6F)	0.30	2.3
B3960	433.92	2520 (DCC6F)	0.34	2.2
B3962	868.30	2520 (DCC6F)	0.60	2.8
B3524	1575.42	2520 (DCC4A)	2.00	1.2
R1801	315.00	2520 (DCC4B)	±25 kHz *	-

* Production tolerance referred to the center frequency

Advantages of the intelligent remote control key

Benefits for automobile manufacturers

- Extended functionality gives them a technological lead
- More attractive keys thanks to innovative design and high-tech functions
- Data stored on the key enables more customer-friendly servicing

Benefits for the motorist

- Access to vehicle data and functions over long distances (for instance from home or office)
- Reliable operation via active feedback
- Comfortable transfer of external data to the automobile computer or navigation systems