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4D transponder coil creating new dimensions for multifunctional car keys

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In the era of IoT and automotive connectivity the car key of the future needs to get smart and offer additional functionalities such as the ability to transmit data or offer a touch display. The new 4D transponder coil with an integrated NFC (near field communication) or wireless power transfer (WPT) coil adds new dimensions for multifunctional car keys.

The future of car keys is data driven. They will have to offer data storage, display and transfer. In the first step of the car key facelift keys will feature the integration of NFC communication capabilities. This enables a number of additional functions for the key, including the readout of car data, non-automotive access systems, e-payments and more. In a further step, the keys will have to offer wireless charging to support the storage and display of detailed car status information and other screen-based applications such as finding a parking space or finding the parked car. In addition, haptic feedback will replace traditional buttons and the rechargeable battery will need a reliable, effective and user-friendly wireless charging system (Figure 1).

Car key of the future

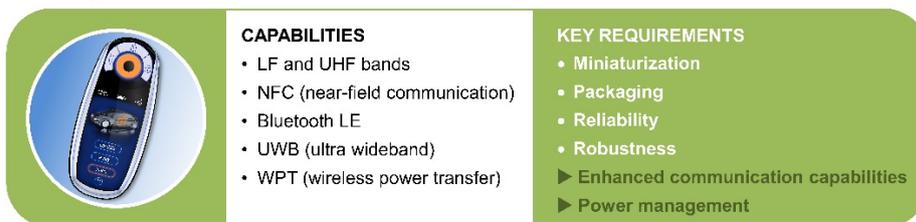


Figure 1: The car key of the future will offer a variety of enhanced communication capabilities and power management.

Compact 4D transponder coil with integrated NFC

The key design feature of the new 4D transponder coil is its integrated NFC coil on the Z axis of the 3D transponder coil housing (Figure 2). By eliminating the use of additional external coils for the enhanced functionality, the new component saves space and minimizes the costs of the electronics, as well as reducing the indirect costs of handling additional components. Moreover, the design offers high reliability and robustness.



Figure 2: The new 4D transponder coil with integrated NFC or WPT.

The inner construction of the 4D transponder coil employs sophisticated ferrite core geometry, in which the NFC coil (operating frequency 13.56 MHz) has an extra winding chamber in the Z axis that is uncoupled from the LF coil on the Z axis (operating frequency 125 kHz). As a result, both coils operate on different frequencies at same time, and the NFC coil is able to achieve a reliable operating distance of up to 5 cm.

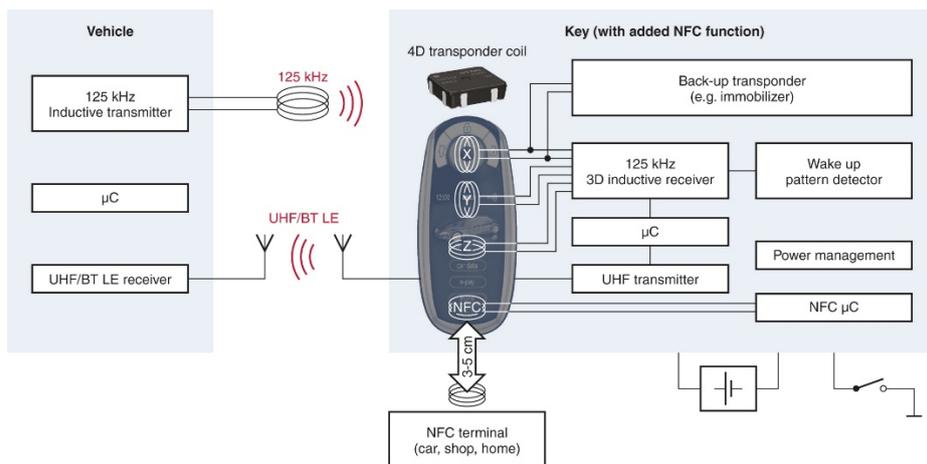


Figure 3: Car key with NFC functionality integrated into the 3D transponder coil package.

Wireless charging for keys with rechargeable batteries

The 4D transponder coil with integrated WPT enables a wireless charging solution for car keys with a display and therefore with a rechargeable battery (Figure 4). For this, the WPT coil is designed for the transfer of 0.5 W. A possible way to implement this additional convenience function would be a charging surface that is located in the center console and is equipped with a WPT Tx coil. As soon as the driver places the key there, the system detects the car key and activates the wireless power transfer so that the key is charged conveniently while driving.

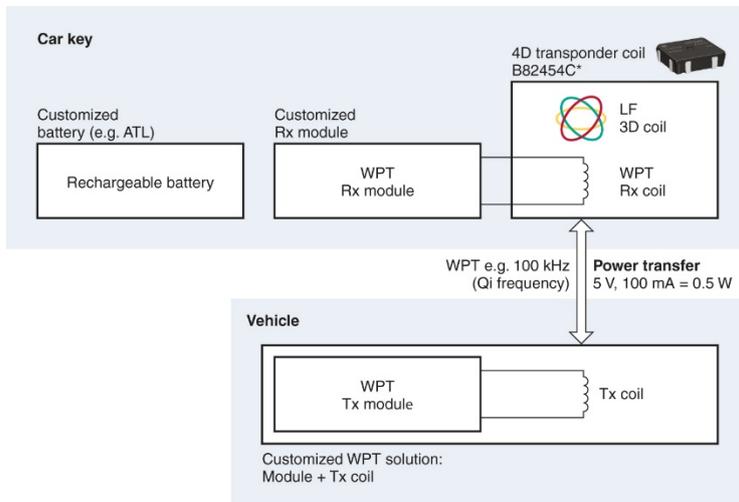


Figure 4: WPT system based on a car key with a 4D transponder coil featuring an integrated WPT coil.

Outlook

Mass production of the TDK 4D transponder coil is scheduled to begin in 2020 with the current size of 12.5 mm x 11.5 mm x 3.6 mm. Samples for selected customer projects will be available on request starting in the summer of 2019.

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