

Attracting Tomorrow



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New dimensions for multifunctional car keys

4D transponder coil with integrated NFC or wireless charging coils

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Car keys of the future: Data-driven with added functionality

Main interface between car owner and car with increasing functionality

- Ignition / starting
- Access / entry
- Security / immobilizer
- Remote keyless entry / PEPS

PLUS

- ▶ Data storage
- ▶ Data display
- ▶ Data transfer
- ▶ Non-automotive functions



TDK products for current generation of car keys



**3D
transponder coils**



**Single axis
transponder coils**



MLCCs



RF inductors



COMMUNICATION CAPABILITIES


- LF and UHF bands


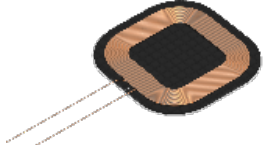
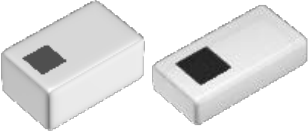


KEY REQUIREMENTS

- Miniaturization
- Functional in any position
- Reliability
- Robustness

One-stop shopping for all necessary passive components

TDK components for future car key generations



<p>4D transponder coils</p>  <ul style="list-style-type: none"> • integrated NFC or • integrated WPT 	<p>Wireless charging coil</p> 	<p>Bluetooth wireless</p> 	<p>Flexible solar battery</p>  <p>In development</p>	<p>EDLC/Li-ion battery</p>  <p>In development</p>
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CAPABILITIES

- LF and UHF bands
- NFC (near-field communication)
- Bluetooth LE
- UWB (ultra wideband)
- WPT (wireless power transfer)

KEY REQUIREMENTS

- Miniaturization
- Packaging
- Reliability
- Robustness
- ▶ Enhanced communication capabilities
- ▶ Power management

The world's first 4D coils with integrated NFC or wireless power transfer capability

The new 4D transponder coil with integrated NFC or wireless power transfer

FEATURES

- Thermally stable ferrite core with special core geometry
- Flame-retardant molding
- Laser-welded
- Long receiving distance at 125 kHz
- Qualified to AEC-Q200
- High sensitivity in all orientations (X/Y/Z)
- **4th coil for NFC or wireless power transfer**

KEY DATA

Axis	X	Y	Z	NFC (Z axis)
Rated inductance [mH]	6.75	6.75	13.20	0.85 μ H
Q_{typ} [110%/+15%]	23.5	24.5	18.5	-
S_{typ} [mV/ μ T]	77	73	77	-
F_{res} [kHz]	430	450	290	60 MHz
$R_{DC,max}$ [Ω]	92	95	335	2.3

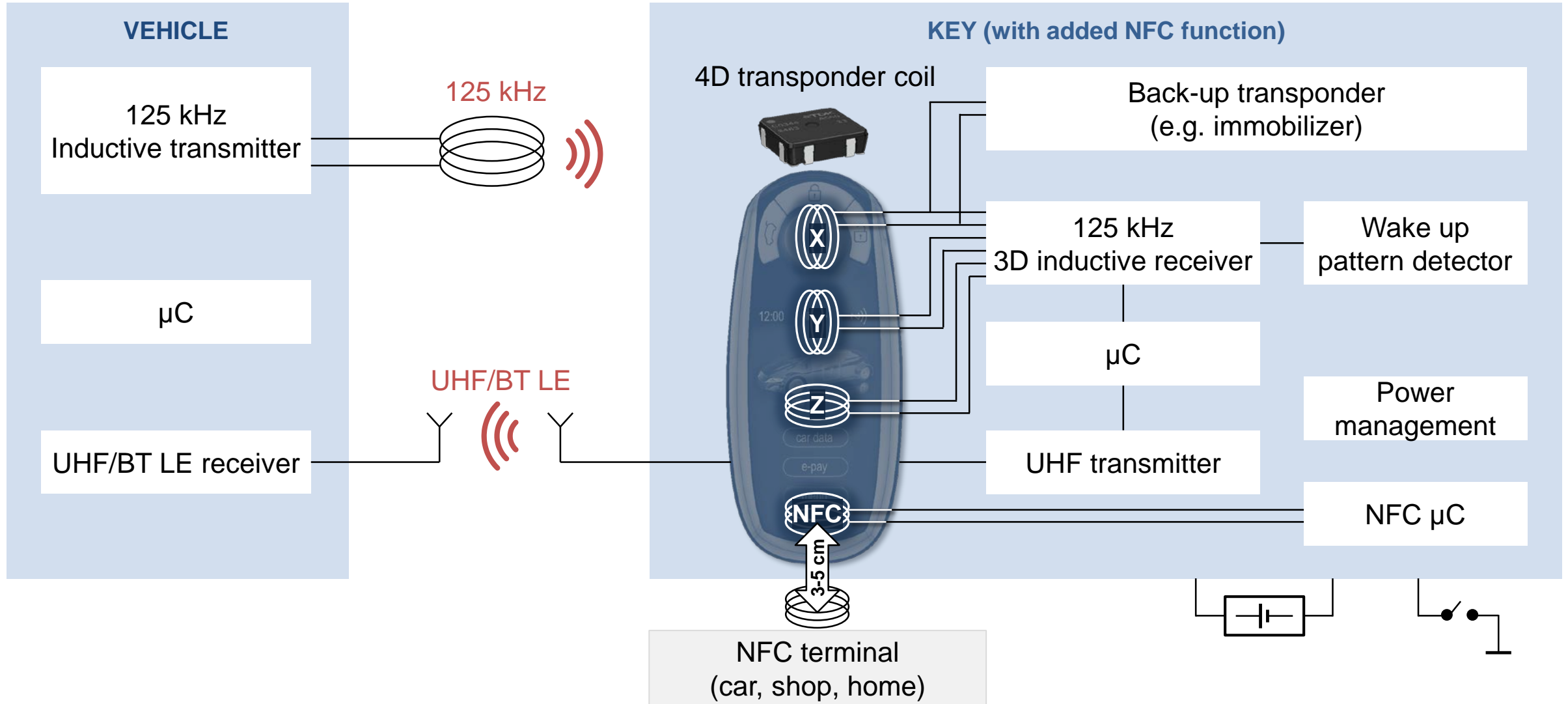


12.5 mm x 11.5 mm x 3.6 mm

APPLICATIONS

- **NEW:** NFC applications
- **NEW:** Wireless power transfer
- Passive entry, passive start (PEPS)
- LF antenna coil for wake-up and immobilizer

4D transponder coil with integrated NFC for advanced communication capabilities



Benefits of the 4D coil with integrated NFC

Emergency opening without metal keys or cylinders



Easy read-out of car status and diagnostics data stored on key

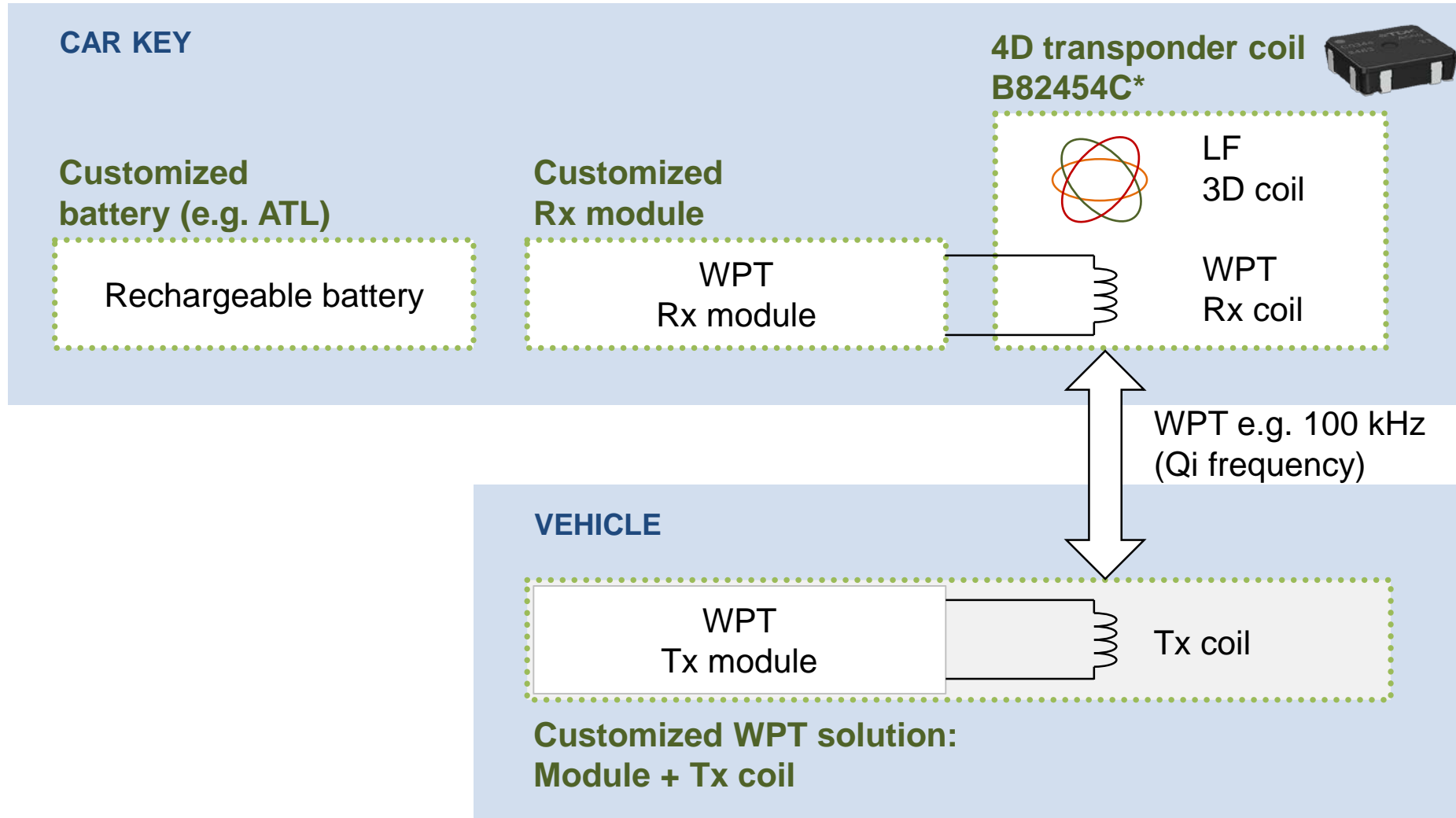


Non-automotive access and payment systems



Car key with NFC enables new application possibilities

4D transponder coil with integrated WPT enables easy and high-efficiency wireless charging



Power transfer
5 V, 100 mA = 0.5 W

Roadmap for 3D and 4D transponder coils



Driving enhanced performance and miniaturization of automotive and non-automotive access systems



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