Use case:

secure, digital key cards for car access

Having a contactless smartcard as the primary means of accessing a vehicle or as a backup or alternative key, enhances convenience and provides peace of mind. The MIFARE DUOX IC from NXP, a smartcard IC compliant with automotive regulations, offers fast ECC-based authentication for quick and easy deployment of secure, digital key cards for car access.

Applications

- Vehicle lock/unlock
- Vehicle engine start
- Key card sharing
- Car sharing
- Car rentals
- Valet parking
- Fleet management

Challenge/solution explanation

Challenge

The car connectivity consortium (CCC) specification for digital key, first released in 2018, turns a smartphone or smartwatch into a virtual key for your vehicle. Based on ultra-wideband (UWB), Bluetooth® low energy (BLE) and near field communication (NFC) technologies, CCC digital key works with any operating system and lets your device securely store, authenticate and share your access privileges, for a level of security and privacy that rivals a physical key.

CCC digital key also lets you open and start your car without having to present your device to the vehicle—your device can stay in your pocket or bag—and the key function works even if your device's battery is low.

The convenience and versatility problem

However, if your smartphone or smartwatch is malfunctioning or out of battery, relying on a key fob as a backup can be cumbersome and may not always be convenient when you are away from home.

Moreover, everyday events, such as using valet parking, taking your vehicle for service, getting your car washed or loaning your car to a friend, can involve temporarily giving someone a key for use when you're not there. Here again, a smart key fob can be bulky and inconvenient to keep on hand and can be expensive to replace if lost while on loan. Having a relatively inexpensive and lightweight smartcard key, to loan out as needed, gives you the flexibility to let others access your car without handing over your smartphone, smartwatch or electronic key fob.

Solution

A contactless smartcard performs as a primary and a backup or alternate key. NFC-enabled smartcards are less costly than key fobs to issue, can operate without a battery and are easy to store in a wallet, your smartphone cover or even the car's glove box.

They're a convenient solution for opening and starting your car if your usual device is inoperable or unavailable, can easily be loaned out without significant risk and are both a more convenient and more robust alternative to a mechanical key or a conventional key fob.

MIFARE DUOX: optimized for automotive applications

NXP's MIFARE DUOX is a contactless NFC IC that is ideally suited for use in smartcard keys for car access applications. Optimized for the automotive applications, MIFARE DUOX complies with automotive-related regulatory requirements, including ISO/SAE 21434, for cybersecurity risk management and MISRA-C software development guidelines. The MIFARE DUOX smartcard chip undergoes automotive-like qualification at the silicon level, including cold test and offers an extended, automotive-grade chip operating temperature range of -40 °C to +105 °C at silicon level.

Future-proof cryptographic algorithms

In terms of security, MIFARE DUOX supports a selection of future proof cryptographic algorithms, symmetric cryptography with advanced encryption standard (AES) 128 and AES 256 as well as asymmetric cryptography with elliptic curve cryptography (ECC) 256 making use of the well-known PKI concept. The MIFARE DUOX implementation of ECC-based mutual authentication is ideally suited to be used for initial pairing between the smartcard and the vehicle and performs authentication in just 90 ms, a rate that is significantly faster than authentication based on other products and methods. MIFARE DUOX also supports proximity check, an NFC feature that protects against relay attacks, which helps to avoid unauthorized access to the vehicle and car theft. Furthermore it is common criteria EAL 6+ certified on both the hardware and software layers, making it suitable for high-security use cases like car access.

MIFARE DUOX also supports multi-application use cases, making it possible to add other functions, such as garage access, electric vehicle charging, car sharing, bike sharing and more to one single digital key smartcard.

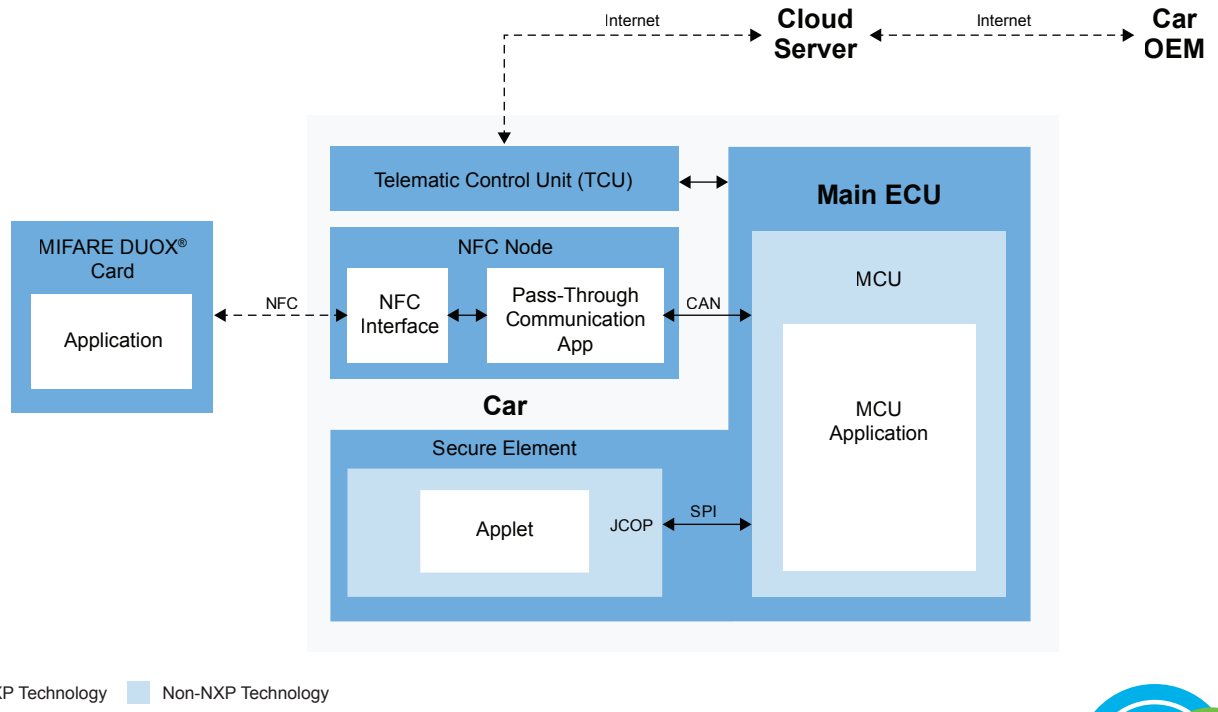
Learn more

Check out the supplementary application note "AN14221 MIFARE DUOX for secure car access and automotive use cases" to dive deeper into how the MIFARE DUOX smartcard IC can be utilized to implement secure and reliable digital key card system solutions.

The NXP design community site offers helpful hints, easy-to-follow how to's and detailed application notes for use with MIFARE solutions, while our product pages link to detailed specs, designs tools and software, training and support and more.

- NXP design community
- NXP MIFARE family landing page

MIFARE DUOX car architecture block diagram



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