



TABLE OF CONTENTS



Introduction

Bird's Eye View

Executive Summary

The Basics

What's New

Analysis

Summary Tables

Ecosystem

Future Outlook

Next Steps

Contact Us

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A growing number of intelligent systems and technologies are being installed as standard in new vehicles today, with even more in development and set for installation in the near future. While the most commonly marketed innovations by OEMs stem from the vehicle's HMI and infotainment systems, this innovation extends to safety and security.



Cyber Security

#712

Digital Key Guide

The increased presence of software-based features and systems inside the vehicle has led to a rise in the number of experiences hosted on a smartphone. The most notable of these is the digital key, which sees the user's smartphone leveraged to unlock/lock and start the vehicle. Today, it is widely seen as a premium feature – with select luxury OEMs offering it as standard and mass market automakers providing it as an optional feature in premium packages or higher trim models.

In the future, however, digital key systems – especially those that utilize a smartphone – could become an increasingly common user experience. Likewise, as they become more accessible through native vehicle integrations, alongside new partnerships between OEMs and consumer electronics firms, digital keys could replace current passive smart key systems and potentially replace the key fob altogether.

Updated annually in .PPT and .XLS formats, the Digital Key Guide tracks the latest trends and offerings from OEMs across three major regions. Similarly tracked are the features and pricing models of each system as well as the technologies used to produce them. Through dedicated releases for the USA, Europe, and China, the report understands how the fitment and maturity of digital keys can vary around the world.

COVERAGE



GLOBAL



NA



CHINA



EUROPE

FREQUENCY



ANNUALLY



Bi-Annually



ONE-OFF

PUBLICATION FORMAT



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POWERPOINT



EXCEL



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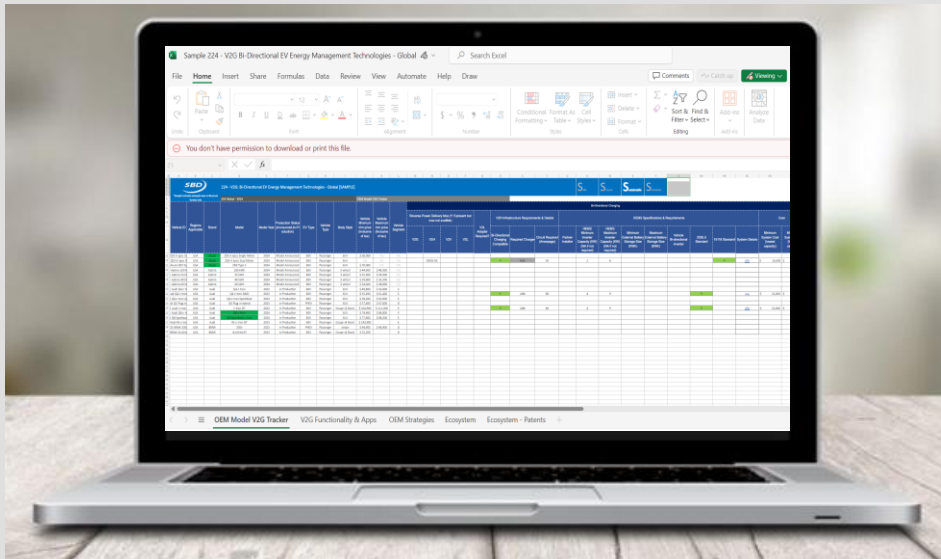
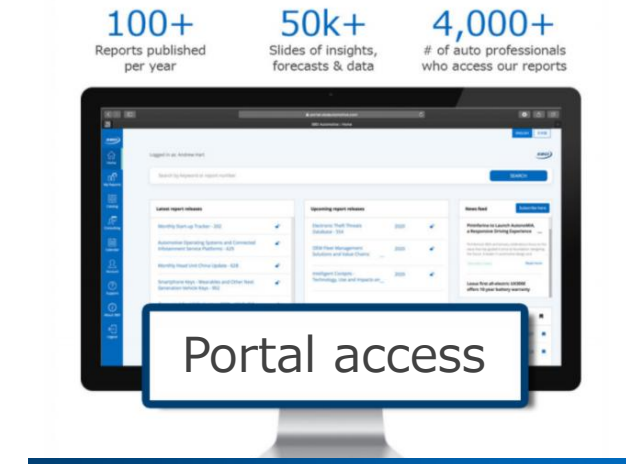
Key questions answered

- > Which models offer Digital Keys and by what technologies?
- > What features and pricing models are being launched by OEMs?
- > What are the latest developments from the Digital Key ecosystem?
- > What are the main technologies being deployed to support Digital Key technologies?

This research supports



Do I have access?



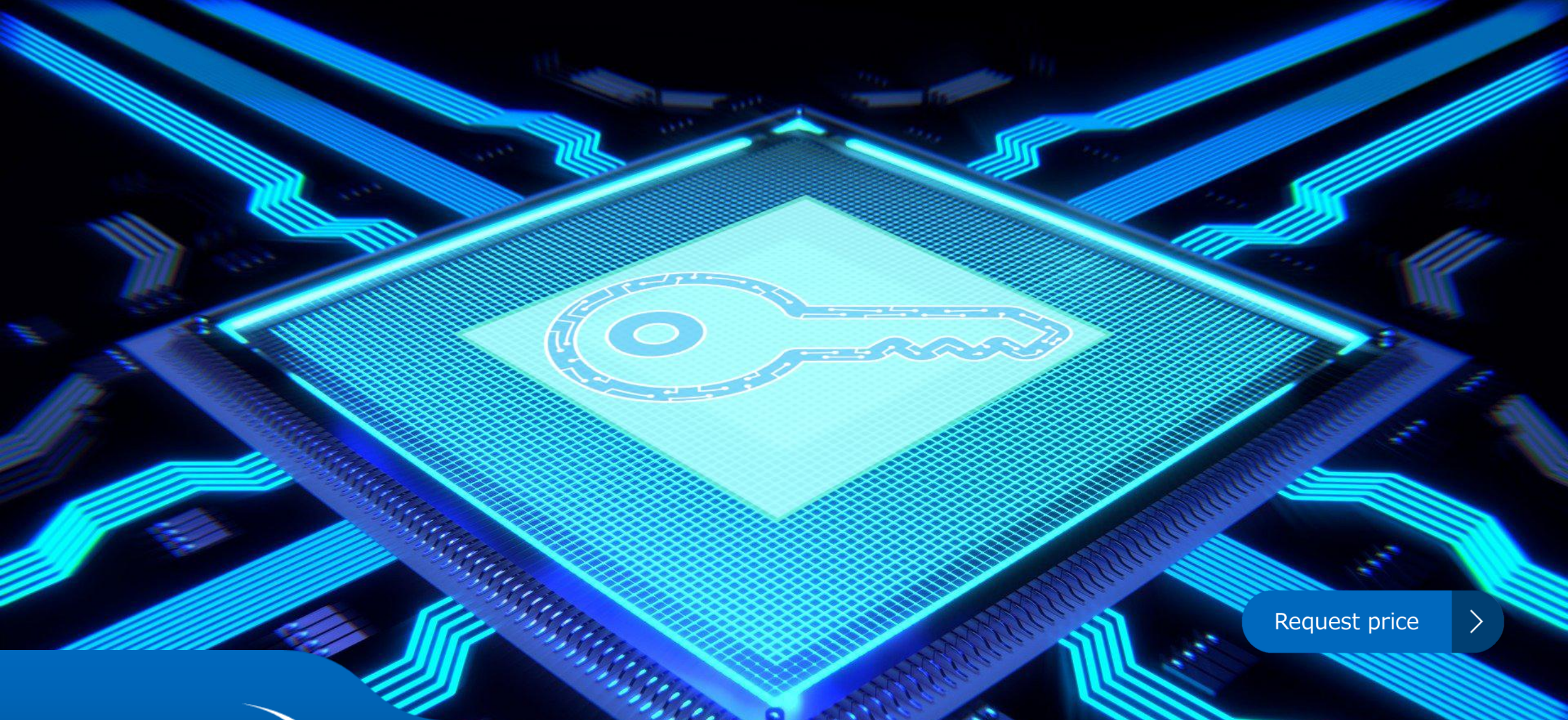
View Excel Data Sheet Sample

Digital Key Guide

Track the latest digital key system trends and offerings from OEMs

Click for Sample





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Digital Key Guide

712 - Digital Key Guide - Europe

Introduction »	4	Summary Tables »	44	Birds Eye View »	61
Executive Summary »	6	▪ Understanding Summary Table			
The Basics »	13	▪ Digital Key Scoring		Future Outlook »	69
What's New? »	23	▪ BMW Group ▪ BYD Group ▪ Ford Group ▪ Geely Group ▪ Honda Group ▪ Hyundai Group		Next Step »	76
▪ Notable announcements ▪ Partnership and Acquisition ▪ Case Study		▪ Mercedes-Benz Group ▪ NIO ▪ Tesla Motors ▪ Volkswagen Group ▪ Other OEMs ▪ Explore		Contact Us »	83
Analysis »	28				
▪ Industry Standards ▪ Technology ▪ Digital Key Regulations ▪ State-of-the-art ▪ Statistics ▪ Partnerships ▪ System Trends ▪ Vehicle access trends ▪ Key sharing trends ▪ Challenges ▪ Explore					



Introduction

Digital Key is becoming a mainstream offering

Digital key systems are not just seen as an **attractive replacement for key fobs**, but also offer a method of sharing and revoking keys over the air. Since the **introduction of passive entry passive start (PEPS)** systems, customers have grown used to convenient ways to unlock and start the vehicle without having to operate the key fob. For the digital key systems to be seen as a long-term option, OEMs must develop systems that **offer more features, be as easy and as simple to use** as what they are replacing and **be secure**.

The **712-Digital Key Guide** details how this can happen, what technologies are currently being used and the **standard changes, best practice guidance and system developments** that will likely shape future system designs. Through these considerations, this report identifies the major drivers and barriers for the **FOUR key OEM motivations for digital key space**.



Shared Usage



Simplifying Complexity



Revenue Flexibility



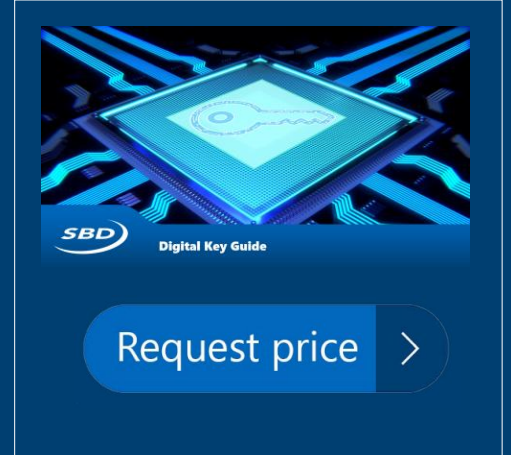
New Experiences

What are the key findings of this report?

- What are the associated features/attributes of digital key technology being offered by OEM groups/brands?
- Where are OEMs positioned in terms of technologies (NFC/BLE/UWB) and security of the digital key feature?

Layer	Section	Conclusion
STRATEGY & IMPACT	Executive Summary	Digital key standards, technologies, the evolution of digital keys, future predictions on the types of features that may be available, the main challenges, and a snapshot of the current market landscape.
	The Basics	Overview of the digital regulations, standards and the different technologies implemented by the OEMs
	What's New?	New product launches, partnerships and other announcements in the digital key space
LEARNING & ACTION	Analysis	In-depth information on the trends and features of digital keys, offered by the OEMs.
	Summary Tables	Summarizing the trends identified in the associated Excel spreadsheet database, a score is given to each system.
CORE INSIGHTS	Deep Dive	 View and analyze deep data in your own way
	Markets	
	Announcements	
	Rankings	
	Definitions	
DATA DEEP DIVE IN EXCEL	Birds Eye View	An overview of the tangential trends to this topic, as identified in SBD's neighboring products
	Future Outlook	Four OEM personas are considered against drivers and barriers into the future to understand when Digital Key benefits will be truly realized.
	Next Steps	Can SBD help you with any unanswered questions?
CONTEXT		

Example slides from the report





Getting consumers to trust digital key

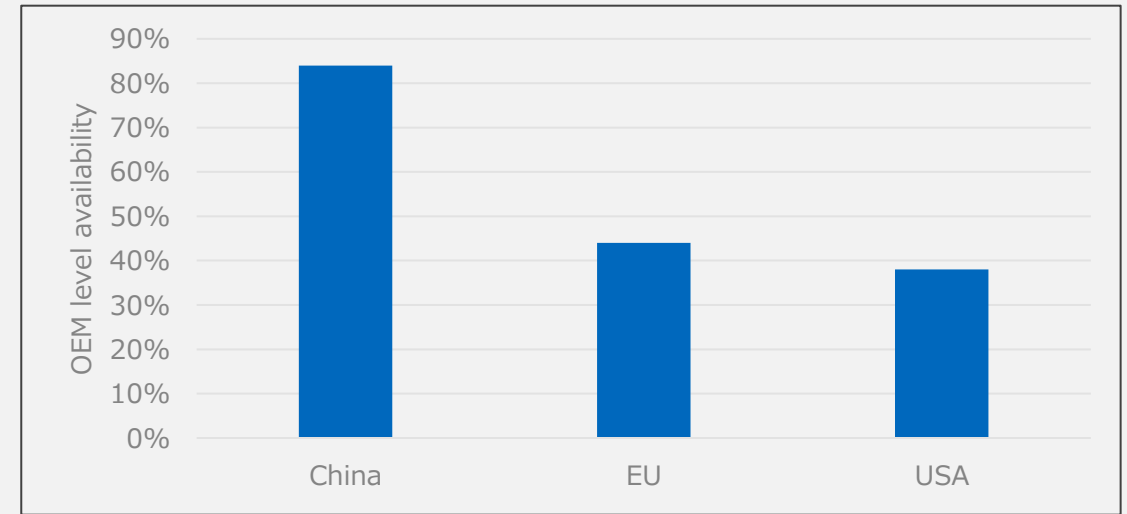
Digital key needs to gain consumer confidence in order to replace the key fob as the default vehicle key.

When the mega volume OEMs roll out digital key, consumers will start to get accustomed to using it.

Systems must be reliable to gain consumer trust.

Having a back-up system will greatly improve consumer confidence.

OEM with Digital key



Opportunities



In the long term, OEMs may further integrate digital key systems with traditional key fobs by introducing BLE-based key fobs. However, reliability is a non-negotiable and will enhance the overall user experience and consumer confidence.

Best Practices

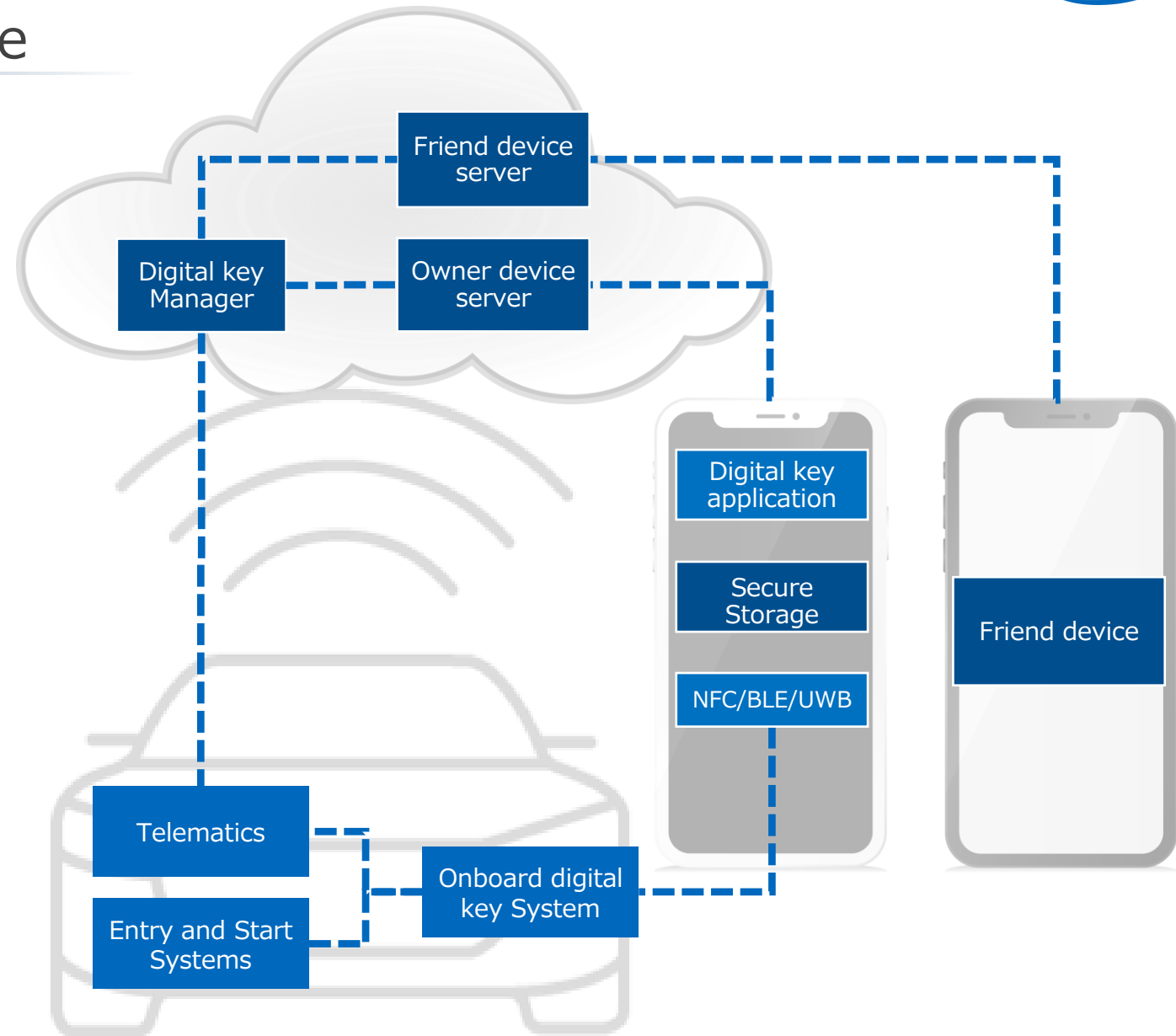


The CCC is playing a vital role in winning customers' trust by making systems a more reliable, compatible and consistent user experience. This know-how could also filter through to OEM proprietary systems.



Simplified system architecture

- This simplified architecture provides an overview of the main components that make up the digital key system.
- Digital keys are assigned from the cloud when the owner registers their device/phone.
- The system is designed to unlock and start the vehicle even if there is no connection between the device and the server.
- The secret key is stored in the embedded Secure Element (eSE) or Trusted Execution Environment (TEE) of the device.





Which technology is being implemented?

The main digital key technologies

Security ↑



Convenience →



NFC is resistant to remote attacks, but **NFC is not as convenient because it doesn't allow passive entry and start.**



One of the main advantages of using BLE over NFC is that it allows **passive** access and start, making it convenient. **However, BLE alone cannot give accurate positioning, making it insecure** against relay and Man-in-the-Middle (MitM) attacks.



When used in combination with BLE, UWB **provides secure passive entry and start with accurate range control.** UWB provides accurate positioning of the smartphone/device to the vehicle. **Accurate positioning will allow the development of more features, functionality and possible use cases.**



HADM is a wireless technology that uses Bluetooth Low Energy (BLE) to measure signal distance and direction. It aims to counter relay attacks. The latest version of HADM is **Channel Sounding** (CS), which focuses on measuring propagation channel characteristics. Another technology **NearLink** is also in contention to power future digital keys as it combines features of Bluetooth, UWB, and possibly Wi-Fi-like capabilities with more precise positioning, low interference, and better locking/unlocking stability

Back-up

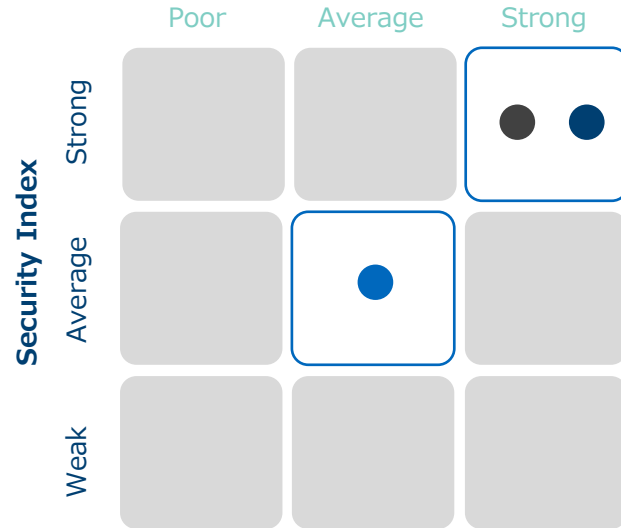
As well as the digital key, OEMs need to consider back-up systems for the following 2 scenarios; when the phone battery depletes (NFC) and when there is a vehicle fault (Mechanical key).

Digital Key → Mechanical Key ↓	NFC	BLE	BLE+NFC	BLE+UWB+NFC
Mechanical key	 	 	 	
Alternative to mechanical key				



BMW Group

User Experience Index



Overview

- BMW has two different digital key offerings. The most popular 'BMW Digital Key' is available on a wide range of models like the 3/4/5/7/8 series and all the SUVs. Recently it was made available in the X2 SUV and 2-series Coupe.
- In 2021, BMW launched its 'BMW Digital Key Plus based on UWB technology which has more features than the incumbent solution. The Digital Key Plus was first launched on the new generation EV models like ix and i7. It is now also available on BMW's high-end SUV range (X5/6/7) and is planned for other models as well. Some MINI models also get this system with more or less similar functionality

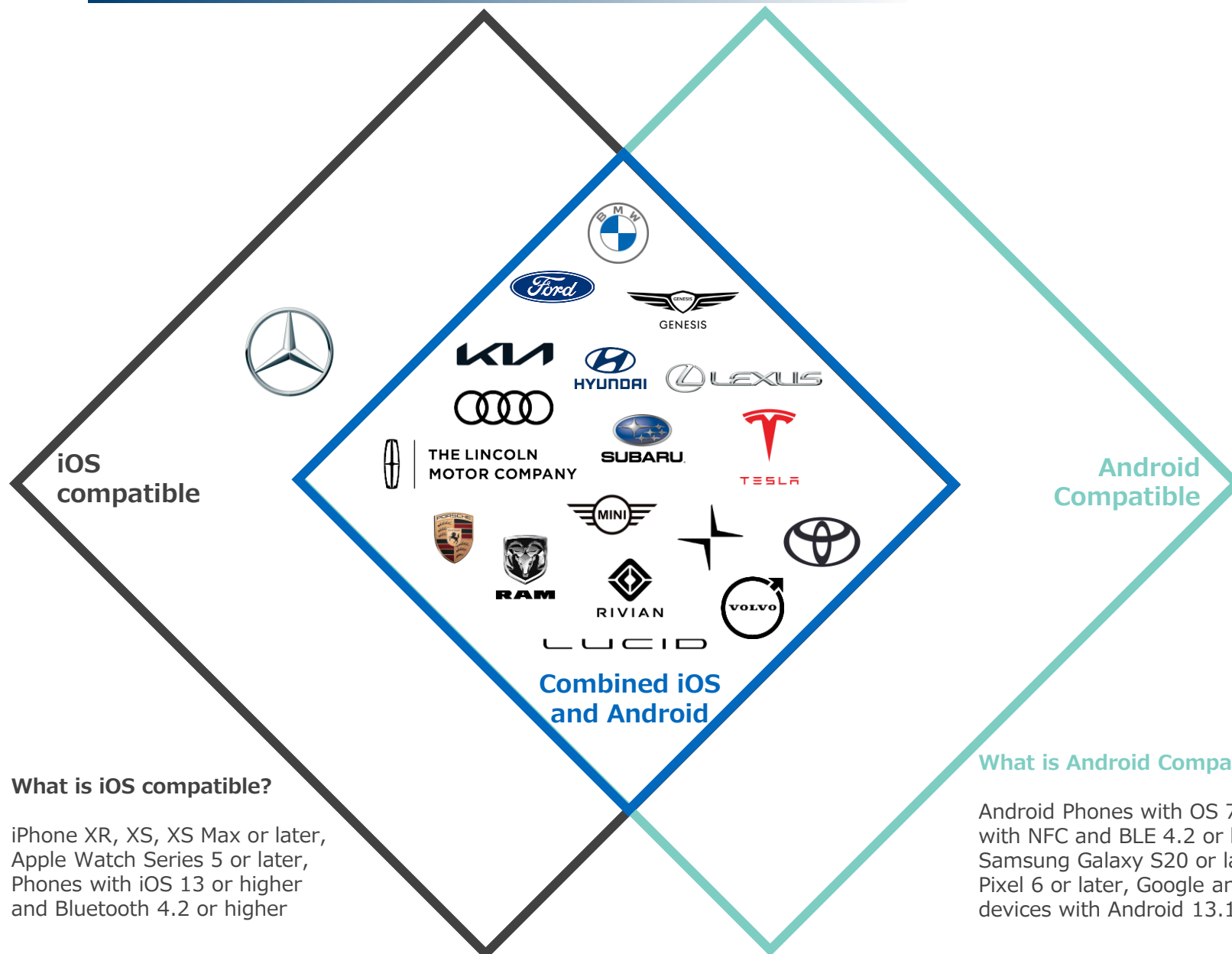
Key Highlights

- The BMW Digital Key (NFC) system was the first CCC R2-compliant system that is compatible with iOS devices. The Digital Key plus (BLE + UWB) system was the first CCC R3 compliant system. This is a significant milestone that puts BMW in the market leader position. BMW is a prominent participant of the CCC and has a strong influence on the standard development
- Compatibility: Newer Samsung / Google phones (Galaxy Sxx series, Pixel 6/7 etc.) with Android 13.1+ are now supported in many European markets.
- BMW provides 5 shared keys for its "BMW Digital Key" product that are only available for Apple devices.

System	Original key needed for pairing	Off-boarding feature	Prevents locking key inside the cabin	Range control	Standards compliance	Passive unlock / start	Advanced features	Shared keys	Multiple key sharing channels	Phone battery low back up	Vehicle failure back up	IOP
BMW Digital Key	•	•		•	•		•	•	•	•	•	•
				NFC system	CCC R2		Personalization	5	App only	NFC phone / card	Mech Key	Android and iOS
BMW Digital Key Plus	•	•		•	•	•	•	•	•	•	•	•
				BLE+ UWB	CCC R3	Both	Both	5	App only	NFC phone / card	Mech Key	iOS only
MINI Digital Key Plus	•	•		•	•	•	•	•	•	•	•	•
				BLE+ UWB	CCC R3	Both	Both	5	App only	NFC phone / card	Mech Key	iOS only



Digital key system trends - Compatibility



What is iOS compatible?

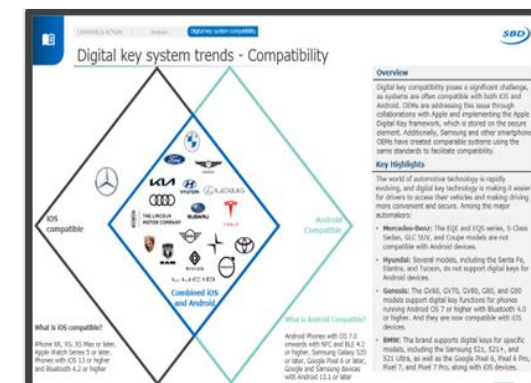
iPhone XR, XS, XS Max or later,
Apple Watch Series 5 or later,
Phones with iOS 13 or higher
and Bluetooth 4.2 or higher

What is Android Compatible?

Android Phones with OS 7.0 onwards
with NFC and BLE 4.2 or higher,
Samsung Galaxy S20 or later, Google
Pixel 6 or later, Google and Samsung
devices with Android 13.1 or later

Overview

Digital key compatibility poses a significant challenge, as systems are often compatible with both iOS and Android. OEMs are addressing this issue through collaborations with Apple and implementing the Apple Digital Key framework, which is stored on the secure element. Additionally, Samsung and other smartphone OEMs have created comparable systems using the same standards to facilitate compatibility.



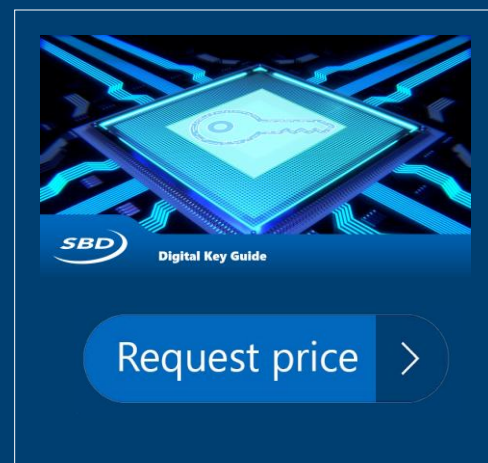
Digital Key Guide

The Digital Key Guide tracks the latest trends and offerings from OEMs across three major regions, along with features and pricing models of each system as well as the technologies used to produce them.

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