



Migrate classic contactless smart card systems to the next security level

MIFARE Plus™

MIFARE Plus™ brings benchmark security to mainstream contactless smart card applications. It is the only mainstream IC compatible with MIFARE Classic™ offering a seamless upgrade path, with minimal effort, for existing infrastructure and services.

Key applications

- ▶ Public transportation
- ▶ Access management, e.g. employee, school or campus cards
- ▶ Electronic toll collection
- ▶ Car parking
- ▶ Loyalty programs

Key features

- ▶ 2- or 4-KB EEPROM
- ▶ Simple fixed memory structure compatible with MIFARE Classic 1 K (MF1ICS50), MIFARE Classic 4 K (MF1ICS70)
- ▶ Access conditions freely configurable
- ▶ Smooth migration from MIFARE Classic to MIFARE Plus security level supported
- ▶ Open standard AES crypto for authentication, integrity and encryption
- ▶ Common Criteria Certification: EAL4+ for IC HW and SW
- ▶ ISO/IEC 14443-A unique serial number, 4 or 7 byte and random IDs
- ▶ Multi-sector authentication, multi-block read and write
- ▶ Anti-tear function for writing AES keys

- ▶ Keys can be stored as MIFARE Classic CRYPTO1 keys (2 x 48 bit per sector) or as AES keys (2 x 128 bit sector)
- ▶ Supports virtual card concept
- ▶ High data rates up to 848 kbit/s
- ▶ Available in MOA4 modules or 8-inch sawn bumped wafer

NXP MIFARE Plus is based on open global standards both for air interface and cryptographic methods. It is available in two versions: MIFARE Plus S, the Slim version, for straightforward migration of MIFARE Classic systems, and MIFARE Plus X, the eXpert version, which offers more flexibility to optimize the command flow for speed, privacy and confidentiality. MIFARE Plus X offers a rich feature set, including proximity checks against relay attacks.

MIFARE Plus is fully functional backwards compatible with MIFARE Classic 1 K / 4 K. Interoperability with MIFARE Classic has been verified by the independent MIFARE™ Certification Institute. MIFARE Plus offers the possibility to issue cards seamlessly into existing MIFARE Classic applications, before the infrastructure is upgraded. Once the security upgrades are in place, MIFARE Plus cards can be switched to a more secure mode in the field with no customer interaction necessary. AES (advanced encryption standard) is then being used for authentication, encryption and data integrity. MIFARE Plus



supports high-speed communication between card and terminal at up to 848 kbps/s, for time critical services. The read range of up to 10 cm increases the convenience of the touch-and-go experience.

Security levels

MIFARE Plus cards supports one pre-personalization and 3 security levels. Cards operate in one security level at any given time and can only be switched to a higher level.

An automatic anti-tear mechanism is available for secure deployment of rolling keys. If a card is removed from the field during a key update, it either concludes the update or automatically falls back to the previous key. NXP recommends 7 Byte UID, but offers 4 B UID versions of MIFARE Plus during migration. MIFARE Plus is available in the proven MOA4 module and as sawn bumped wafers, no changes for existing manufacturing processes necessary. For benchmark security on the reader side, the MIFARE SAM AV2 (secure application module) is available. The Common Criteria 5+ certified IC includes all MIFARE Plus commands,

secure key storage and AES calculation for a reader device. To support the design-in process for reader manufacturers and solutions developers, NXP provides MIFARE Plus documentation, application notes, and software toolkits.

MIFARE pedigree

The NXP MIFARE portfolio is the leading technology platform for contactless ticket, card, and reader solutions. It is a proven and reliable technology and, with more than 15 million reader ICs, 1 billion card ICs, and 800 million smart ticket ICs sold, has the largest installed base worldwide. MIFARE complies with the international standard ISO/IEC 14443 A, ensuring that today's infrastructure can easily be upgraded. It makes it possible for service providers to expand their transportation networks and integrate additional services, such as payment systems for taxi fares, cinema and theatre tickets, loyalty programs, access management, and parking – while reducing the total costs of operations.

- ▶ **Level 0**
MIFARE Plus cards are pre-personalized with configuration keys, level switching keys, MIFARE Classic CRYPTO1 and AES keys for the memory.
- ▶ **Security Level 1**
In this level the cards are 100% functionally backwards compatible with MIFARE Classic 1 K / 4 K cards. Cards work seamlessly in existing MIFARE Classic infrastructure.
- ▶ **Security Level 2**
(MIFARE Plus X only)
Mandatory AES authentication. MIFARE Classic CRYPTO1 for data confidentiality.
- ▶ **Security Level 3**
Mandatory AES for authentication, communication confidentiality and integrity. Optional proximity detection (MIFARE Plus X only)

Product Features	MIFARE Plus S 2k	MIFARE Plus S 4K	MIFARE Plus X 2K	MIFARE Plus X 4K
Memory				
EEPROM size [byte]	2 K	4 K	2 K	4 K
Write endurance [typical cycles]	200 000			
Data retention [years]	10			
Organization	32 sectors with 4 blocks	32 sectors with 4 blocks 8 sectors with 16 blocks	32 sectors with 4 blocks	32 sectors with 4 blocks 8 sectors with 16 blocks
RF-Interface				
Acc. To ISO 14443A	yes - up to layer 4			
Frequency [MHz]	13.56			
Baudrate [kbit /s]	106 ... 848			
Anticollision	bit-wise			
Security				
Unique Serial Number [byte]	4 or 7			
4 byte Random ID	yes in SL3			
True Random Number Generator	yes			
Access keys	CRYPTO1 or AES keys per sector			
Access conditions	per sector			
AES security	CMACing		CMACing / Encipherment	
Anti-tearing	for AES keys, sector trailers and configuration			
Cryptography	AES (128 bit), CRYPTO 1			
Special Features				
Supported MF PLUS levels	SL1, SL3		SL1, SL2, SL3	
Multi-sector authentication			yes	
Virtual card support	yes, limited command set		yes, full command set	
Proximity check	no		yes	
Packaging				
Sawn Wafer (Au Bumped)				
7 byte UID	MF1SPLUS6001DUD	MF1SPLUS8001DUD	MF1PLUS6001DUD	MF1PLUS8001DUD
4 byte UID	MF1SPLUS6011DUD	MF1SPLUS8011DUD	MF1PLUS6011DUD	MF1PLUS8011DUD
MOA4 Module				
7 byte UID	MF1SPLUS6001DA4	MF1SPLUS8001DA4	MF1PLUS6001DA4	MF1PLUS8001DA4
4 byte UID	MF1SPLUS6011DA4	MF1SPLUS8011DA4	MF1PLUS6011DA4	MF1PLUS8011DA4

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