



JCOP V2.4.1

JCOP V2.4.1 secure smart card controller

Rev. 3.2 — 2 September 2009
167532

Product short specification
CONFIDENTIAL

1. General description

NXP Semiconductors offers a Java Card Open Platform operating system called JCOP V2.4.1 based on independent, third party specifications, i.e. by Sun Microsystems, the Global Platform consortium, the International Organization for Standards (ISO), EMV (Europay, MasterCard and VISA) and others. JCOP V2.4.1 family based on the SmartMX family which is manufactured in most advanced CMOS 0.14 μm 5 metal layer technology is positioned to service high volume, single- and multi-application markets such as eGovernment e.g. Smart Passport, banking/finance, mobile communications, public transportation, pay TV, conditional access, network access and digital rights management.

The Java Card, GlobalPlatform, EMV and ISO industry standards together ensure application interpretability for card issuers as well as application providers. By adhering not just to the standards themselves, but also to their spirit as evidenced in numerous heritage applications, JCOP V2.4.1 ensures large interpretability with third party applets as well as all existing smart card infrastructures. With JCOP V2.4.1 the promise of multi-sourcing any component in smart card solutions becomes true. Even in existing infrastructures, JCOP V2.4.1 equipped with proper applications can substitute any existing smart card.

Within its targeted segments, the new JCOP V2.4.1 platform on SmartMX is the most advanced solution available. It is combining standard interfaces as defined in Java Card 2.2.2 (see [Ref. 1](#)), GlobalPlatform Card Specification 2.1.1 (see [Ref. 2](#)) and powerful cryptographic capabilities by using co-processors for public and secret key encryption supporting RSA, ECC and Triple-DES, within the high security, ultra low power, performance optimized design concept of NXP Semiconductors' handshaking technology. The platform supports class "C", "B" and "A" voltage ranges (1.62 to 5.5 V) as required by application standards such as 3G Mobile Communication (3GPP) and the credit/debit card standard (EMV).

For further details on JCOP V2.4.1 platform features and specifications supported by this product refer to [Section 3](#).

For more detailed information refer to following documentation¹:

- Administrator manual, JCOP V2.4.1, Doc.No. 1495xx²
- User manual, JCOP V2.4.1, Doc.No. 1496xx
- Hardware data sheet, JCOP V2.4.1, Doc.No. 1497xx

1. These documents are available under NDA
2. where XX refers to the last version; e.g. 10 refers to version 1.0

The Administrator manual describes JCOP for the administrator of a JCOP card or secure element. This means it explains the pre-personalisation process and its specific commands.

The User manual describes JCOP for the applet developer. It outlines the features available through the Java Card API. Also it explains any additional functionality at the Java layer. Also, this User manual contains the information on how to order JCOP products

The Hardware data sheet explains the details of the JCOP product from a hardware point of view. This means it gives figures like pinning diagram and power consumption.

2. Block diagram

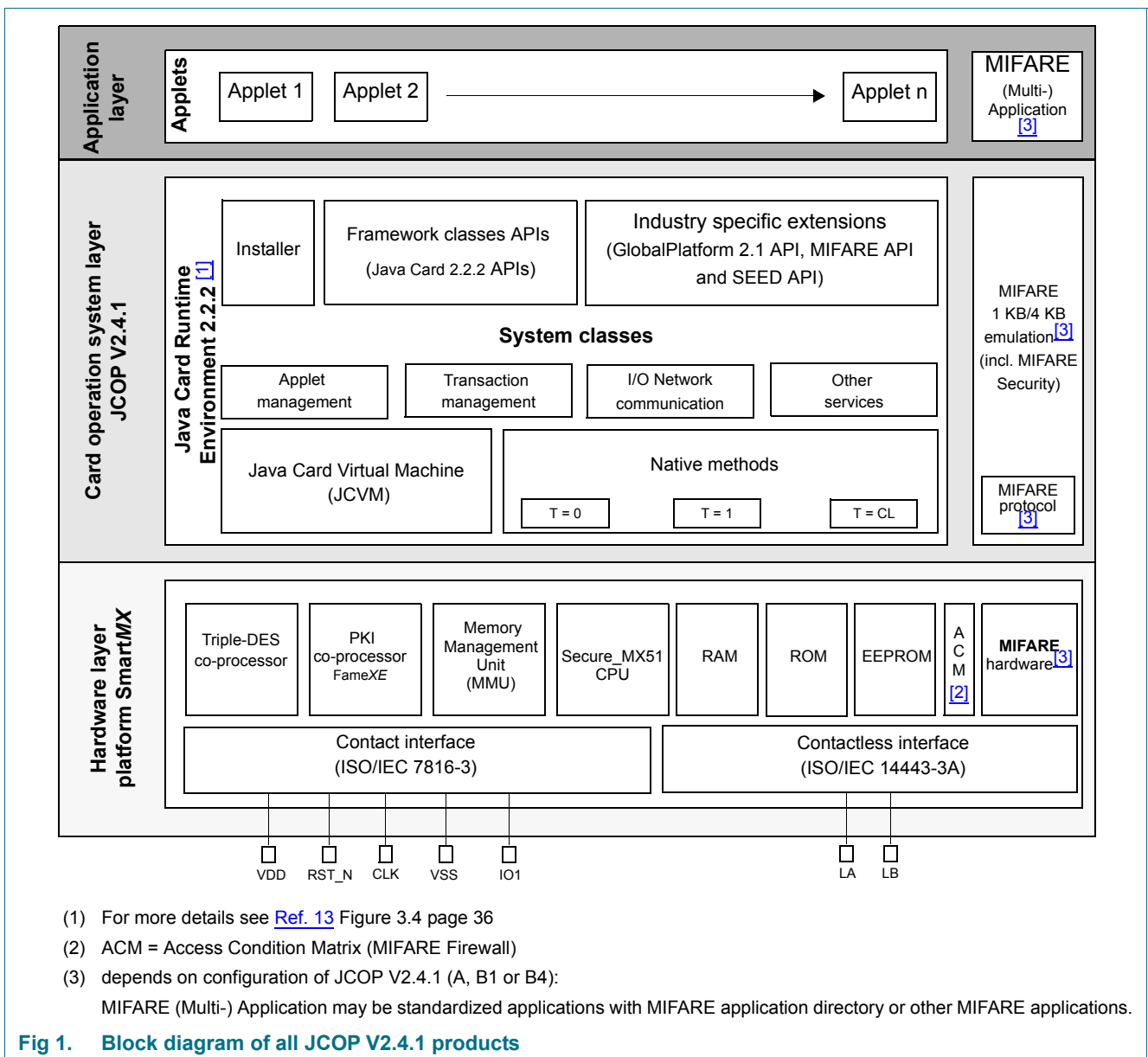


Fig 1. Block diagram of all JCOP V2.4.1 products

3. Specifications supported with JCOP V2.4.1

3.1 Java Card

JCOP V2.4.1 meets Java Card specification V2.2.2 as defined in [Ref. 1](#).

3.2 GlobalPlatform

JCOP V2.4.1 meets Global Platform specification as defined in [Ref. 2](#) and [Ref. 3](#).

3.3 Supported eGovernment specifications and applications

In order to provide extensive support for the eGovernment applications (electronic passports, electronic identification cards), JCOP V2.4.1 is prepared to meet a wide range of relevant specifications. Several applet providers worldwide are developing and testing following applications on JCOP V2.4.1:

- BAC, Basic Access Control according to ICAO 9303 (see [Ref. 10](#) and [Ref. 11](#))
- EAC, Extended Access Control according to BSI TR03110 V1.1 (see [Ref. 12](#))
- Fingerprint Biometric Matching on Card
- Digital Signature according to PKCS#11, IEC/CEN 14980
- European Citizen Card based on IEC/CEN 15480
- Various eID applications based on national specifications

In order to increase performance of the applications where retrieval of large data sets has to be completed as fast as possible, NXP Semiconductors is introducing BAC Accelerator API. For more details refer to JCOP V2.4.1 Administrator and User manual.

3.4 Supported banking specifications

Following sections give general information about support of banking specifications provided with JCOP V2.4.1. Note that full support of these specifications is only possible with the applet performing specific banking operations.

3.4.1 VISA International

Visa GlobalPlatform Card 2.1.1 Implementation Requirements Version 2.0 as defined in [Ref. 4](#) with specific product configurations described in [Ref. 5](#), including support for OpenPlatform 2.0.1 backwards compatibility and its relevant secure messaging methods.

Contactless communication is supported according to the Visa contactless Payment Specification Version 2.0.2 which includes Additions and Clarifications v3.0.

3.4.2 EMV

EMV contactless communication is supported as defined in [Ref. 5](#), [Ref. 6](#), [Ref. 7](#), [Ref. 8](#) and [Ref. 9](#). JCOP V2.4.1 supports all relevant security guidelines for the implementation of EMV applets

3.5 Specifications for transportation and ticketing

JCOP V2.4.1 is prepared to meet various specifications for transportation and ticketing. Configurations with MIFARE emulation with 1 KB or 4 KB EEPROM space provide support for the classic MIFARE ticketing operations.

Additionally, in combination with applets running under JCOP V2.4.1, the operating system ensures flexible support for different authentication mechanisms and implementations of payment options in combination with the eGovernment and banking applets.

4. Additional JCOP V2.4.1 features

4.1 JCOPX - Additional Application Programming Interface (APIs) features

JCOP V2.4.1 provides extended support for several industry specific requirements. This support is given with the JCOPX API that comprises following functionality:

- BAC Accelerator API for secure messaging performance increase
- Extended cryptography support (several algorithms and methods not specified in Java Card v2.2.2 (see [Ref. 1](#)))
- UID options (single [fixed or random] or double UID support) according ISO/IEC 14443-3A

More details about the JCOPX API can be found in JCOP V2.4.1 User Manual.

4.2 MIFARE emulation features

JCOP V2.4.1 provides full support for the MIFARE functionality. JCOP V2.4.1 is available in 3 different configurations:

- Configuration A - no support for MIFARE functionality.
- Configuration B1 - 1 KB MIFARE functionality is supported according to the Java Card specification v2.2.2 (see [Ref. 1](#))
- Configuration B4 - 4 KB MIFARE functionality is based on the same specification with possibility to use up to 255 sectors.

4.3 Extended Length APDU support

- Extended Length APDUs are support for protocols T=1 and T=CL. For T=0 only short APDUs are supported. APDU buffer length is given in [Table 1](#).

4.4 Security features

JCOP V2.4.1 includes extensive support for security applications based on following features:

- Support for Triple-DES co-processor
- AES cryptography based on SmartMX AES cryptographic co-processor
- RSA support for the key lengths up to 2048 bit
- Elliptic Curve Cryptography with key lengths up to 320 bit
- SHA1, SHA-224 and SHA-256
- Support for SEED algorithm
- Support for MD5
- On-Card Key generation
- CRC calculations
- Data Authentication Pattern (DAP) for the Supplementary Security Domains

5. Supported interfaces

JCOP V2.4.1 supports following communication interfaces

- Contact mode: T=0 and T=1 according to ISO/IEC 7816 with 3.5712 MHz following communication speeds are supported:
 - ◆ 9600 bit/s [default]
 - ◆ 19200 bit/s
 - ◆ 38400 bit/s
 - ◆ 57600 bit/s
 - ◆ 115200 bit/s
 - ◆ 223200 bit/s
- Contactless mode: T=CL according to ISO/IEC 14443 Type A with following communication speeds.
 - ◆ 106 kbit/s
 - ◆ 212 kbit/s
 - ◆ 424 kbit/s

6. Memory

6.1 Available memory space

In configuration B1 and B4 with JCOP and MIFARE two different operating system modes are available on one device:

Table 1. Memory Maps for different configurations

Product type	Config	Transient Heap (RAM)	Persistent Heap (EEPROM)	Free ROM for Applets	APDU Buffer
J2A080	-	2406 bytes	76896 bytes	76208 bytes	1462 bytes
J3A080	A	2406 bytes	76896 bytes	76208 bytes	1462 bytes
	B1	2278 bytes	75872 bytes		
	B4		72800 bytes		
J2A040	-	2406 bytes	35940 bytes	76208 bytes	1462 bytes
J3A040	A	2406 bytes	35940 bytes	76208 bytes	1462 bytes
	B1	2278 bytes	34916 bytes		
	B4		31844 bytes		

6.2 Garbage collection

Garbage collection is fully implemented in JCOP V2.4.1; deleted objects, applets, and packages are fully reclaimed (incl. compactification) and the space can be used for other purposes after deletion.

7. Supported hardware platforms

JCOP V2.4.1 runs on the following HW platforms:

- NXP Semiconductors SmartMX P5CD080V0B (J3A080)
- NXP Semiconductors SmartMX P5CD040V0B (J3A040)
- NXP Semiconductors SmartMX P5CC080V0B (J2A080)
- NXP Semiconductors SmartMX P5CC040V0B (J2A040)

With this HW platform it is possible to have products in contactless or dual interface mode.

- contactless package (NXP Semiconductors MOB6, MOB4) for all J3 products
- dual interface (NXP Semiconductors PDM1.1) for all J3 products
- contact (NXP Semiconductors PCM1.1) for all J2 products

Wafers with particular JCOP V2.4.1 configuration (A, B1, B4, contact or dual interface) and other packages (i.e. SMD, HVQN) can be created and delivered on specific customer request. For more information refer to [Section 8](#).

8. Ordering information

8.1 JCOP V2.4.1 naming conventions

The following table explains the naming conventions of the commercial product name of the JCOP V2.4.1 products. Every JCOP V2.4.1 product gets assigned such a commercial name, which includes also customer and application specific data. This table does not give any information about which commercial products are Common Criteria certified.

The JCOP V2.4.1 commercial names have the following format.

Jabcccxdd(d)/mvsrrffo

The 'J' is a constant, all other letters are variables, which are explained in the following [Table 2](#).

Table 2. JCOP Commercial Name Format

Variable	Meaning	Example Values	Parameter settings
a	Hardware Type	1	SC hardware (no PKI, no contactless interface)
		2	CC hardware (no contactless interface)
		3	CD hardware
b	JCOP version	A	JCOP V2.4.1 on one of: <ul style="list-style-type: none"> • P5CD080V0B • P5CC080V0B • P5CD040V0B • P5CC040V0B
ccc	EEPROM size in KB	080	80 KB EEPROM
		040	40 KB EEPROM
x	JCOP type	G	Generic
		C	Customized
		others	others are possible and are application dependent
dd(d)	Delivery type	UA	150um sawn wafer, inkless
		UE	75um sawn wafer, inkless
		X0	PDM module
		X1	PDM 1.1 plug-in module
		A4	MOB4
		A6	MOB6
		others	other delivery forms
m	Manufacturing Site Code	T	
v	Silicon Version Code	0	
s	Silicon Version Subcode	B	
rr	ROM Code ID		
ff	FabKey ID		
o	Option	0	Config A (No MIFARE)
		1	Config B1 (MIFARE 1K)
		4	Config B4 (MIFARE 4K)

8.2 Ordering JCOP V2.4.1 products and support items

8.2.1 JCOP V2.4.1 product configurations

With the explanation given in the [Section 8.1](#) following product type name configurations could be available from NXP Semiconductors:

Table 3. Ordering information of JCOP V2.4.1

Type number ^{[1][2]}	Package		Version
	Name	Description	
J3A080xA4/...	MOB4	plastic leadless module carrier package; 35 mm wide tape	SOT500-2
J3A080xA6/...	MOB6	plastic leadless module carrier package; 35 mm wide tape	SOT500-3
J3A080xX0/...	PDM1.1	contactless chip card module (super 35 mm format, 8-contact)	SOT658
J3A080xX1/...	PDM1.1	contactless chip card module (Plug-in type; super 35 mm format, 8-contact)	SOT658
J3A080xUA/...	FFC	8 inch wafer (sawn; 150 µm thickness; on film frame carrier; electronic fail die marking according to SECSII format)	
J3A080xUE/...	FFC	8 inch wafer (sawn; 75 µm thickness; on film frame carrier; electronic fail die marking according to SECSII format)	
J3A080xAi/...		Inlay (index i contains capital character [A-Z])	
J3A040xA4/...	MOB4	plastic leadless module carrier package; 35 mm wide tape	SOT500-2
J3A040xA6/...	MOB6	plastic leadless module carrier package; 35 mm wide tape	SOT500-3
J3A040xX0/...	PDM1.1	contactless chip card module (super 35 mm format, 8-contact)	SOT658
J3A040xX1/...	PDM1.1	contactless chip card module (Plug-in type; super 35 mm format, 8-contact)	SOT658
J3A040xUA/...	FFC	8 inch wafer (sawn; 150 µm thickness; on film frame carrier; electronic fail die marking according to SECSII format)	
J3A040xUE/...	FFC	8 inch wafer (sawn; 75 µm thickness; on film frame carrier; electronic fail die marking according to SECSII format)	
J3A040xAi/...		Inlay (index i contains capital character [A-Z])	
J2A080xX0/...	PCM1.1	PCM1.1 module (PST)	
J2A080xXK/...	PCM1.1	PCM1.1 module (NedCard)	
J2A080xXS/...	PCM1.1	PCM1.1 module (dual source)	
J2A080xUA/...	FFC	8 inch wafer (sawn; 150 µm thickness; on film frame carrier; electronic fail die marking according to SECSII format)	
J2A080xTS/...	SSOP20	SSOP20 package	
J2A040xX0/...	PCM1.1	PCM1.1 module (PST)	
J2A040xXK/...	PCM1.1	PCM1.1 module (NedCard)	
J2A040xXS/...	PCM1.1	PCM1.1 module (dual source)	
J2A040xUA/...	FFC	8 inch wafer (sawn; 150 µm thickness; on film frame carrier; electronic fail die marking according to SECSII format)	
J2A040xTS/...	SSOP20	SSOP20 package	

[1] Refer also to JCOP v2.4.1 Administrator manual, Section 8 "Customer's type submission by using Order Entry Form".

[2] x = G, C, or other according the COP V2.4.1 type classification see the JCOP v2.4.1 Administrator manual.

8.2.2 Available JCOP V2.4.1 products

Table 4. JCOP V2.4.1 product overview

Product type	Java Card	Global Platform	VGP config. 1, 2, 3	Appl. backward compatible VGP 2.0.1 ^[1]	MIFARE	Interface and protocols				ICEEPROM [KB] ^[2]
						ISO/IEC 7816 T=0, T=1	ISO/IEC 14443A T=CL	NFC S2C	USB 2.0	
J3A080	2.2.2	2.1.1	3	yes	yes	yes	yes	no	no	80
J2A080	2.2.2	2.1.1	3	yes	no	yes	no	no	no	80
J3A040	2.2.2	2.1.1	3	yes	yes	yes	yes	no	no	40
J2A040	2.2.2	2.1.1	3	yes	no	yes	no	no	no	40

[1] To configure JCOP V2.4.1 to be application backward compatible contact NXP Semiconductors Customer Application Support (CAS)

[2] Further information on available EEPROM size for each product refer to the [Section 6.1](#)

Table 5. JCOP V2.4.1 product feature map

Product type	Cryptographic features									Additional features			
	AES	Triple-DES	RSA [bit]	ECC GF(p) [bit]	On Card Key Gen.	SHA1	MD5	SEED	CRC	Global PIN	MSD/DAP	Applet loading	MIFARE API
J3A080	yes	yes	2048	320	yes	yes	yes	yes	yes	yes	yes	yes	yes
J2A080	yes	yes	2048	320	yes	yes	yes	yes	yes	yes	yes	yes	no
J3A040	yes	yes	2048	320	yes	yes	yes	yes	yes	yes	yes	yes	yes
J2A040	yes	yes	2048	320	yes	yes	yes	yes	yes	yes	yes	yes	no

8.3 Ordering JCOP V2.4.1 samples

It is possible to order samples in following delivery types from NXP Semiconductors.

1. MOB4 contactless modules
2. MOB6 contactless modules
3. PDM1.1 dual interface modules (standard and plug-in type with contacts on C4 and C8)
4. Contactless and dual interface white cards
5. Contactless and dual interface printed cards (NXP Semiconductors layout)
6. (On request) wafers with specific JCOP v2.4.1 configuration based on HW platform (see [Section 7 “Supported hardware platforms”](#))

Note that NXP Semiconductors can provide up to 50 modules and up to 5 cards free of charge. Larger quantities have to be ordered separately. Valid NDA has to be in place before samples are shipped.

Contact your local NXP Semiconductors representative for further information.

8.4 Ordering generic JCOP V2.4.1 products

8.4.1 Ordering generic products from NXP Semiconductors stock

NXP Semiconductors has created several generic product types that are available for ordering. Delivery types 1, 2, 3 and 6 (see [Section 8.3](#)) are available for such ordering.

All products ordered from NXP Semiconductors Stock will have same product type, 12NC number, transport and authentication key.

Contact your local NXP Semiconductors representative for further information.

8.4.2 Ordering generic products through Order Entry Form

In the cases where customer specific product type, 12NC number, transport and authentication key are desired, customer will have to fill NXP Semiconductors Order Entry Form for JCOP V2.4.1 product.

Contact your local NXP Semiconductors representative for further information on OEF availability.

8.5 Ordering JCOP V2.4.1 custom products

8.5.1 Ordering custom products created by NXP Semiconductors

For the customer convenience, NXP has created JCOP V2.4.1 Custom ROM masks that already contain applets supporting eGovernment applications.

Contact your local NXP Semiconductors representative for further information.

8.5.2 Creating and ordering custom products with customer applets in the ROM mask

It is possible to include customer applets in the free ROM space of the JCOP V2.4.1. Customer will have to prepare, test and verify applet functionality on the generic JCOP V2.4.1 sample.

Product type creation and submission of the applet is enabled through the NXP Semiconductors Order Entry Form for JCOP V2.4.1.

Contact your local NXP Semiconductors representative for further information on OEF availability.

8.6 Ordering JCOP V2.4.1 support items

8.6.1 JCOP V2.4.1 transport and authentication keys

Pre-personalization phase for the JCOP V2.4.1 products is possible only with the Transport Key.

Authentication key can be used for verification of the JCOP V2.4.1 authenticity during the pre-personalization.

Customer will need at least the Transport Key for not pre-personalized samples of JCOP V2.4.1.

More details about transport and authentication key and information how to order them can be found in JCOP V2.4.1 User Manual.

8.6.2 JCOP V2.4.1 tools

JCOP tools provide integrated development environment (IDE) based on the ECLIPSE framework and specific JCOP product family through the JCOP tools plug-in.

Contact your local NXP Semiconductors representative for further information on JCOP V2.4.1 tools (plug-in) availability.

9. Security certifications

Following security certificates apply for JCOP V2.4.1

- For the underlying HW platforms (see [Section 7 “Supported hardware platforms”](#)):
CC EAL5+
- For the JCOP V2.4.1 Card Operating System: CC EAL 5+

All JCOP V2.4.1 products are prepared for composite security evaluation and certification of the customer applets. Note that NXP Semiconductors does not perform any security certification for applets running on the JCOP V2.4.1.

Contact your local NXP Semiconductors representative for further information on JCOP V2.4.1 certification.

10. Abbreviations

Table 6. Abbreviations JCOP

Acronym	Description
ACM	Access Condition Matrix
APDU	Application Protocol Data Unit as defined in ISO/IEC 7816
CRC	Cyclic redundancy check
DES	Data Encryption Standard
EEPROM	Electrically Erasable Programmable Read Only Memory
KB	1024 bytes
RAM	Random Access Memory
ROM	Read Only Memory

11. References

- [1] Sun Microsystems: Java Card 2.2.1 <http://java.sun.com/products/javacard>
- [2] Global Platform Consortium: GlobalPlatform Card Specification 2.1.1, March 2003 <http://www.globalplatform.org/>
- [3] GlobalPlatform Consortium: GlobalPlatform; Card Specification 2.1.1 Amendment A, March 2004
- [4] Visa International: Visa GlobalPlatform 2.1.1 Card Implementation Requirements Version 2.0; Effective: July 2007
- [5] Visa GlobalPlatform 2.1.1 Card Implementation Requirements Configuration 1, 2 and 3 ("VGPCIR 1", "VGPCIR 2", "VGPCIR3") version 1.0 dated May 2003
- [6] EMV Contactless Communication Protocol Specification - V2.0, August 2007
- [7] EMV Contactless Communication Protocol Specification V2.0, List of Changes, August 03, 2007
- [8] EMVCo Contactless Communication Protocol Specification replaces the PayPass - ISO/IEC 14443 Application Note #4, March 31, 2006
- [9] PayPass - ISO/IEC 14443 Implementation Specification, Version 1.1 - March 31, 2006
- [10] Machine Readable Travel Documents Technical Report, Development of a Logical Data Structure - LDS, For Optional Capacity Expansion Technologies, Revision -1.7, published by authority of the secretary general, International Civil Aviation Organization, LDS 1.7, 2004-05-18
- [11] Machine Readable Passport - Volume 2 Specifications for Electronically Enabled Passports with Biometric Identification Capabilities, Sixth edition, published by authority of the secretary general, International Civil Aviation Organization, 2006
- [12] German Federal Office for Information Security (BSI): "Technical Guideline TR03110: Advanced Security Mechanisms for Machine Readable Travel Documents - Extended Access Control (EAC)", Version 1.1
- [13] Java Card™ Technology for Smart Cards, Zhiqun Chen, ISBN 0-201-70329-7

12. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
167532	2 September 2009	Product short specification		167531
Modifications:				
				<ul style="list-style-type: none"> • Section 1 “General description” on page 1: corrected in third paragraph References: (see Section 3.1) -> “Ref. 1” and (see Section 3.2) -> “Ref. 2” • Figure 1 “Block diagram of all JCOP V2.4.1 products” on page 2: corrected in Figure note 1 Ref. 17> “Ref. 13” • Section 3.1 “Java Card” on page 3: added Ref. 1 • Section 3.2 “GlobalPlatform” on page 3: rewording • Section 3.3 “Supported eGovernment specifications and applications” on page 3: renamed section title and rewording • Section 3.4.1 “VISA International” on page 3: rewording • Section 3.4.2 “EMV” on page 3: rewording • Section 4.1 “JCOPX - Additional Application Programming Interface (APIs) features” on page 5: rewording • Section 4.2 “MIFARE emulation features” on page 5: added in “Configuration B1see Ref. 1” • Section 4.3 “Extended Length APDU support” on page 5: added paragraph “APDU buffer” • Table 1 “Memory Maps for different configurations” on page 6: update • Section 7 “Supported hardware platforms” on page 7: rewording • Table 2 “JCOP Commercial Name Format” on page 8: update • Table 3 “Ordering information of JCOP V2.4.1” on page 9: update • Table 4 “JCOP V2.4.1 product overview” on page 10: update • Table 5 “JCOP V2.4.1 product feature map” on page 10: update • Section 8.3 “Ordering JCOP V2.4.1 samples” on page 11: added new bullet paragraph “(On request) wafers...” • Section 8.5.1 “Ordering custom products created by NXP Semiconductors” on page 12: added new section • Section 8.5.2 “Creating and ordering custom products with customer applets in the ROM mask” on page 12: added new section • Section 9 “Security certifications” on page 13: rewording • Section 11 “References” on page 15: update
167531	18 December 2008	Product short specification		167530
Modifications:				<ul style="list-style-type: none"> • Table 1 “Memory Maps for different configurations”: removed 1 KB in B1, B4 (EEPROM) and ROM
167530	9 December 2008	Product short specification		
Modifications:				<ul style="list-style-type: none"> • Initial version

13. Legal information

13.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

13.2 Definitions

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