ETSI TS 102 671 V12.0.1 (2018-07)

Smart Cards;
Machine to Machine UICC;
Physical and logical characteristics
(Release 12)

Reference
RTS/SCP-T090071vc01

Keywords
M2M, MFF

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Smart Card Platform (SCP).

The contents of the present document are subject to continuing work within TC SCP and may change following formal TC SCP approval. If TC SCP modifies the contents of the present document, it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

- 0 early working draft;
- 1 presented to TC SCP for information;
- 2 presented to TC SCP for approval;
- 3 or greater indicates TC SCP approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document details the technical specifications for M2M UICCs.

Specifically, the present document specifies:

- Physical, logical and electrical specifications for additional machine to machine form factors for the M2M UICC.
- Environmental specifications of the M2M UICC dedicated to M2M applications for all specified UICC form factors.
- Device pairing mechanisms that allow the M2M UICC to verify the terminal with which it is operating.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- In the case of a reference to a TC SCP document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 102 221: "Smart Cards; UICC-Terminal interface; Physical and logical characteristics".

[2] ETSI TS 102 412: "Smart Cards; Smart Card Platform Requirements Stage 1".

[3] ETSI TS 102 613: "Smart Cards; UICC - Contactless Front-end (CLF) Interface; Part 1: Physical and data link layer characteristics".

[4] ETSI TS 102 600: "Smart Cards; UICC-Terminal interface; Characteristics of the USB interface".

[5] ETSI TS 102 484: "Smart Cards; Secure channel between a UICC and an end-point terminal".

[6] ETSI TS 102 223: "Smart Cards; Card Application Toolkit (CAT)".

[7] IPC/JEDEC J-STD-020D.1: "Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices".

[8] JEDEC JESD22-A104D: "Temperature Cycling".

[9] JEDEC JESD22-B103B: "Vibration, Variable Frequency".

[10] JEDEC JESD22-B104C: "Mechanical Shock".

[11] JEDEC JESD22-A107B: "Salt Atmosphere".

NOTE: For JEDEC documents see http://jedec.org/download/.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- In the case of a reference to a TC SCP document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

M2M communication module: electronics system including all necessary components to establish wireless communications between machines

NOTE: M2M communication modules are usually integrated directly into target devices, such as Automated Meter Readers (AMRs), vending machines, alarm systems, automotive equipment or others.

M2M UICC: UICC with specific properties for use in M2M environments, this includes existing form factors and the new form factors MFF1 and MFF2

Machine to Machine (communication): communication between remotely deployed devices with specific responsibilities and requiring little or no human intervention, which are all connected to an application server via the mobile network data communications

MFF (M2M Form Factor): new form factor dedicated to M2M applications

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ASCII	American Standard Code for Information Interchange
CAT	Card Application Toolkit
ESN	Electronic Serial Number
IMEI	International Mobile Equipment Identity
IMEISV	International Mobile Equipment Identity and Software Version
M2M	Machine to Machine (communication)
MEID	Mobile Equipment IDentifier
MFF	Machine to Machine Form Factor
PCB	Printed Circuit Board

4 Overview

The present document details:

- The environmental specification of the M2M UICC both for the existing form factors and for the optional form factor MFF.
- The definition of the environmental classes for the M2M UICC.
- The physical characteristics of the M2M UICC.
- The electrical specifications of the M2M UICC.
- The logical characteristics of the M2M UICC.
- The definition of device pairing mechanisms between the M2M UICC and the terminal.

The requirements and several use cases for the M2M UICC are detailed in ETSI TS 102 412 [2].

5 Definition of Environmental Classes

5.1 Environmental condition classification system

5.1.0 Environmental property indicators

The following classification system allows the easy identification of the M2M UICC's environmental performance.

The M2M UICC shall be classified with a string representing its environmental performance. This string has two characters for each environmental property and is separated from each condition by a "-" (e.g. TA-FA-…-RA). The first letter defines the environmental property as detailed in table 5.1 and the second letter is the level of support for this property as defined in each clause.

If a M2M UICC does not meet any level specified in the present document for a particular environmental property then this property shall not be present in the string representing its environmental performance. There is no defined order for the environmental properties.

Table 5.1: Description of the environmental property indicators

Environmental property letter	Description of environmental property	Property details in clause
T	Operational and storage temperature	5.2
M	Moisture/Reflow conditions	5.3
H	Humidity	5.4
C	Corrosion	5.5
V	Vibration	5.6
S	Shock	5.8
R	Data Retention time	5.9
U	Minimum Updates	5.10

5.1.1 Storage of environmental properties

The M2M UICCs environmental properties shall be stored in an Elementary File under the Master File according to the classification system defined in clause 5.1.0.

5.1.2 $EF_{ENV-CLASSES}$

$EF_{ENV-CLASSES}$ is a transparent file under the MF and is under the responsibility of the issuer. It provides information about the UICC capabilities to external entities.

Table 5.1a: $EF_{ENV-CLASSES}$ at MF-level

Identifier: '2F07'		Structure: Transparent		Mandatory
SFI: Optional				
File size: X bytes		Update activity: low		
Access Conditions: READ ALW UPDATE ADM DEACTIVATE ADM ACTIVATE ADM				
Bytes	**Description**		**M/O**	**Length**
1 to X	Environmental property classes		M	X bytes

The EF stores the environmental property classes supported by the M2M UICC as defined for the classification system in clauses 5.1 to 5.10. The coding shall be as for an alpha identifier using SMS default 7-bit coding with bit 8 set to 0 (see ETSI TS 102 223 [6]), e.g. "TA-H'54412D4841'.

5.2 Operational and Storage Temperature (TX)

5.2.0 Overview

The TX property defines the M2M UICC performance for operational and storage temperature.

Support of a given temperature range for a M2M UICC operation implies that the M2M UICC shall withstand the following conditions:

- 500 temperature cycles within the full supported range;
- 2 cycles per hour.

Testing temperature cycling shall be in accordance to JESD22-A104 [8].

5.2.1 Temperature (TS) -25 °C to +85 °C

M2M UICCs indicating TS as their temperature property shall conform to the storage and operational temperature specifications detailed in ETSI TS 102 221 [1] for the standard temperature range.

5.2.2 Temperature (TA) -40 °C to +85 °C

M2M UICCs indicating TA as their temperature property shall conform to the storage and operational temperature specifications detailed in ETSI TS 102 221 [1] for class A specific UICC environmental conditions.

5.2.3 Temperature (TB) -40 °C to +105 °C

M2M UICCs indicating TB as their temperature property shall conform to the storage and operational temperature specifications detailed in ETSI TS 102 221 [1] for class B specific UICC environmental conditions.

5.2.4 Temperature (TC) -40 °C to +125 °C

M2M UICCs indicating TC as their temperature property shall conform to the storage and operational temperature specifications detailed in ETSI TS 102 221 [1] for class C specific UICC environmental conditions.

5.3 Moisture/Reflow conditions (MX)

5.3.0 Overview

The MX property defines the M2M UICC performance for moisture/reflow conditions that may be experienced during the manufacturing of the M2M communication module.

5.3.1 Moisture/Reflow conditions (MA)

M2M UICCs indicating MA shall support at least the following moisture/reflow conditions according to IPC/JEDEC J-STD-020D [7]:

- Classification Temperature (T_c) of 260 °C supporting Pb-Free process.
- Moisture Sensitivity Level 3.
- Pb-Free Assembly reflow profile class.

5.4 Humidity (HX)

5.4.0 Overview

The HX property defines the M2M UICC performance in humid conditions.

5.4.1 Humidity (class HA) - High humidity

M2M UICCs indicating HA as their humidity property shall support the high humidity condition as specified in ETSI TS 102 221 [1] specific UICC environmental conditions.

5.5 Corrosion (CX)

5.5.0 Overview

The CX property defines the M2M UICC performance in corrosive conditions.

5.5.1 Corrosion (CA to CD) - Salt atmosphere

M2M UICCs indicating CA, CB, CC or CD shall be able to pass the salt atmosphere test according to JESD22-A107 [11].

The following test condition (referring to the duration of exposure to the salt atmosphere) apply.

Table 5.2

Environmental property indicators	Test condition as specified in JESD22-A107 [11]
CA	A
CB	B
CC	C
CD	D

5.6 Vibration (VX)

5.6.0 Overview

The VX property defines the M2M UICC performance in vibrating conditions.

5.6.1 Vibration (VA) - Automotive vibration

M2M UICCs indicating VA as their vibration property shall be able to pass the variable frequency vibration tests according to JESD22-B103 [9] with test levels as defined in service condition 1 for the swept sine test; optional random vibration tests as defined in JESD22-B103 [9] are not applicable for the VA vibration property.

5.7 Void

5.8 Shock (SX)

5.8.0 Overview

The SX property defines the M2M UICC susceptibility to shock.

5.8.1 Shock (SA) - Automotive shock

M2M UICCs indicating SA as their shock property shall be able to pass the mechanical shock tests according to JESD22-B104 [10] with test levels as defined in service condition B.

5.9 Data Retention Time (RX)

5.9.0 Overview

The RX property defines the M2M UICC's ability to retain data over time.

5.9.1 Data Retention Time (RA) - 10 years

M2M UICCs indicating RA as their data retention time property shall be able to fully operate with no loss of stored information over a 10 year period from the time of manufacture. Loss of information due to multiple erase/write cycles is excluded from this property.

5.9.2 Data Retention Time (RB) - 12 years

M2M UICCs indicating RB as their data retention time property shall be able to fully operate with no loss of stored information over a 12 year period from the time of manufacture. Loss of information due to multiple erase/write cycles is excluded from this property.

5.9.3 Data Retention Time (RC) - 15 years

M2M UICCs indicating RC as their data retention time property shall be able to fully operate with no loss of stored information over a 15 year period from the time of manufacture. Loss of information due to multiple erase/write cycles is excluded from this property.

5.10 Minimum Updates (UX)

5.10.0 Overview

The UX property defines the M2M UICC's expected minimum number of UPDATE commands (as specified in ETSI TS 102 221 [1]) supported for specified files, which are indicated as "high" in the "update activity" field.

5.10.1 Minimum Updates (UA) - 100 000

M2M UICCs indicating UA as their minimum number of UPDATE commands property shall be able to update the specified file(s), 100 000 times without failure. Loss of information due to time factors is excluded from this property.

5.10.2 Minimum Updates (UB) - 500 000

M2M UICCs indicating UB as their minimum number of update commands property shall be able to update the specified file(s), 500 000 times without failure. Loss of information due to time factors is excluded from this property.

5.10.3 Minimum Updates (UC) - 1 000 000

M2M UICCs indicating UC as their minimum number of update commands property shall be able to update the specified file(s), 1 000 000 times without failure. Loss of information due to time factors is excluded from this property.

6 M2M UICC - Physical Characteristics

6.0 Basic requirements

Unless otherwise specified in the present specification the M2M UICC shall conform to the physical characteristics of the UICC as defined in ETSI TS 102 221 [1].

6.1 General M2M UICC physical characteristics

6.1.0 Introduction

This clause defines the general physical characteristics for the M2M UICC, both for the existing form factors and for the MFF.

6.1.1 Contacts

The logical definition of the contacts C1 to C8 shall be as defined in ETSI TS 102 221 [1].

6.2 Specific MFF physical characteristics

6.2.0 Introduction

This clause defines the specific physical characteristics for the MFF.

Two form factors are defined and called hereafter MFF1 and MFF2:

- MFF1 is well adapted for socketing.
- MFF2 offers the possibility to have a large heatsink in the middle.

NOTE: The MFF1 central contacts also allow heatsink dissipation.

6.2.1 MFF1

6.2.1.0 Dimensions

The MFF1 shall have the following dimensions outlined in figure 6.1 and a thickness of 0,50 mm to 0,65 mm.

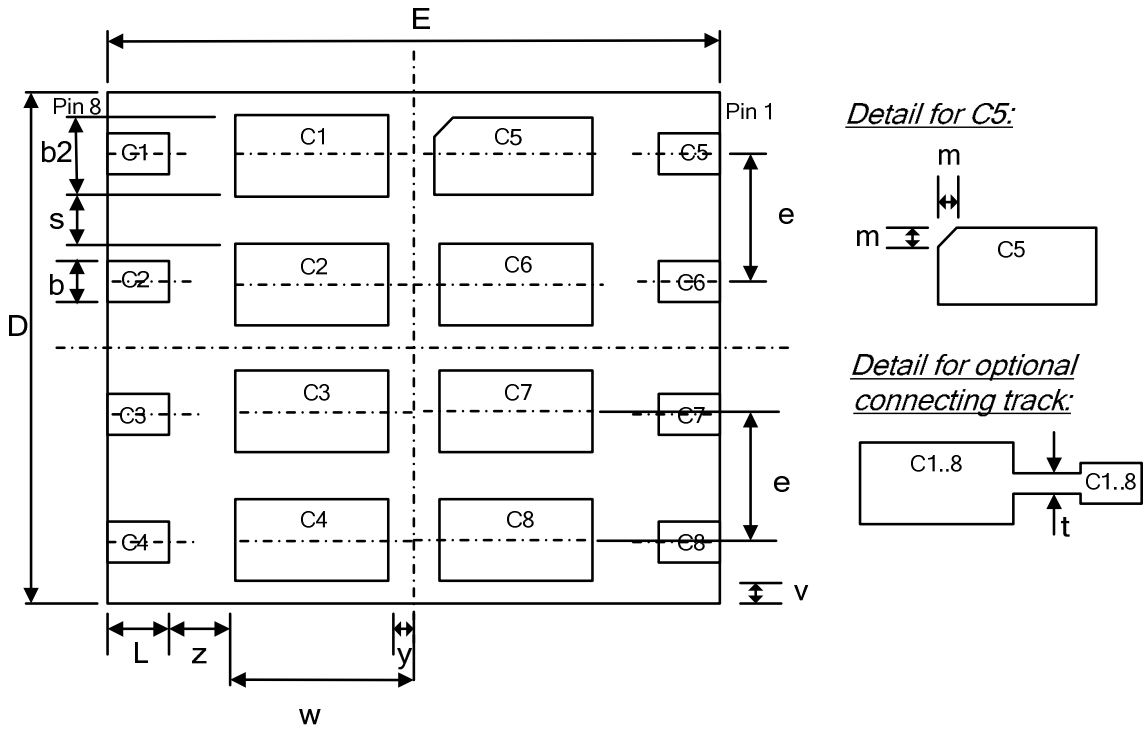

Figure 6.1: MFF1 bottom view

The inner tips of the outer contacting pads may be rectangular or rounded.

Table 6.1: Package pin to UICC contact mapping

Package pin	UICC contact
1	C5
2	C6
3	C7
4	C8

Package pin	UICC contact
8	C1
7	C2
6	C3
5	C4

Table 6.2: Dimensions of the MFF1

Parameter	Description	Dimensions (mm)
E	The package body dimension in the horizontal direction.	6,00 ± 0,10
D	The package body dimension in the vertical direction.	5,00 ± 0,10
L	The length of the outer contacting pad as measured from the edge of the package.	0,60 ± 0,15
s	The vertical distance from the bottom of the inner contacting pad to the top of the next inner contacting pad.	min 0,20
w	The horizontal distance from the centre of the package to the furthest side of the inner contacting pad.	min 1,75
z	The horizontal distance from the nearest sides of the outer and the inner contacting pad.	min 0,20
t	the width of the connecting track that may connect corresponding inner and outer contacting pads on the surface of the MFF1.	max 0,20
y	The horizontal distance from the centre of the package to the nearest side of the inner contacting pad.	0,20 ± 0,10
v	The vertical distance between the side of the package and the nearest side of the nearest inner contacting pad.	min 0,10
b	The width of the outer metallised outer contacting pads (including lead finish) exposed at the bottom surface of the package.	0,40 ± 0,10
b2	The width of the inner metallised contacting pads (including lead finish) exposed at the bottom surface of the package. The inner contacting pads may be elongated in the vertical direction without staying centred with the horizontal axis of the corresponding outer contacting pad as long as the gap between contacts is greater than s and the gap from the inner contacting pad to the edge of the package is greater than v and a minimum width of 0,7 mm stays centred with the horizontal axis of the corresponding outer contacting pad.	min 0,70
e	The centreline-to-centreline spacing of the inner and outer contacting pads.	1,27 for tolerances see parameters bbb and ddd
bbb	The tolerance that controls the position of the contact pattern with respect to the horizontal package centreline. The centre of the tolerance zone for each contact is defined by basic dimension e as related to the horizontal package centreline.	0,10
ddd	The tolerance that controls the position of the contacts to each other. The centres of the profile zones are defined by basic dimension e.	0,05
m	Horizontal and vertical size of orientation mark.	0,25 ± 0,05

As outlined in figure 6.1, each MFF1 contact (C1 to C8) shall comprise the following contact areas:

- one small outer contacting pad aligned with the edge of the package; plus
- one larger inner contacting pad.

The inner and outer pads belonging to the same contact shall be electrically connected in the MFF1. This connection may be on the surface as long as the connecting track's width t is compliant with what is indicated for this parameter in table 6.2.

6.2.1.1 Orientation mark for the bottom of the package

An orientation mark shall be visible on the inner C5 contacting pad.

6.2.1.2 Orientation mark for top of package

The top of the package shall have an orientation mark located in the same corner as contact C5.

6.2.2 MFF2

6.2.2.1 Dimensions

Figure 6.2 defines various dimensions of the package layout seen from the bottom side.

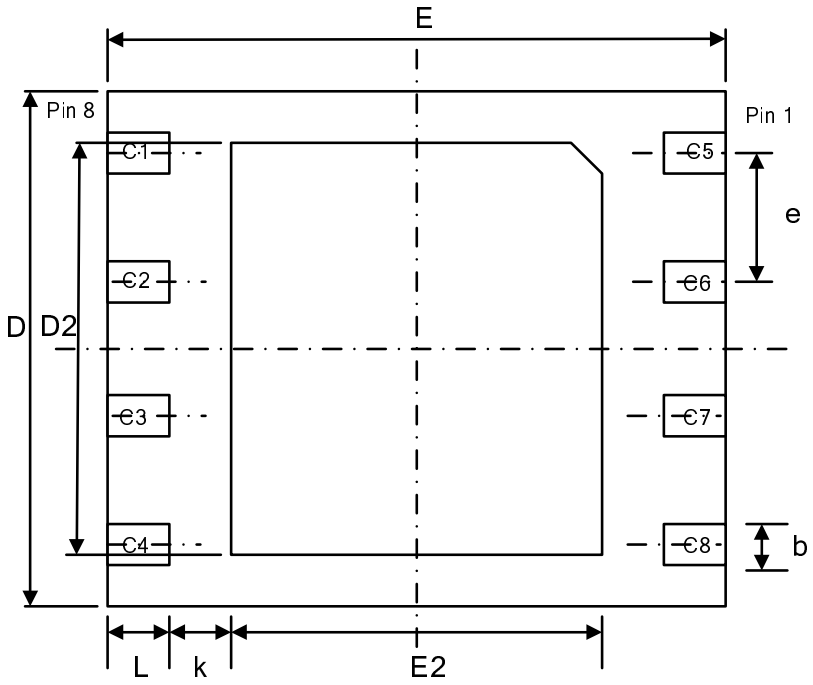

Figure 6.2: MFF2 bottom view

The inner contact tips may be rectangular or rounded.

Package pin to UICC contact mapping is defined in table 6.1.

Table 6.3: Dimensions of the MFF2

Parameter	Description	Dimensions (mm)
E	The package body dimension in the horizontal direction.	6,00 ± 0,15
D	The package body dimension in the vertical direction.	5,00 ± 0,15
L	The length of the contact as measured from the edge of the package.	0,60 ± 0,15
b	The width of the metallised contacts (including lead finish) exposed at the bottom surface of the package.	0,40 ± 0,10
E2	The horizontal dimension of the exposed metal heat feature (exposed die pad).	min 3,30
D2	The vertical dimension of the exposed metal heat feature (exposed die pad).	min 3,90
k	The gap between any contact and the heat feature.	min 0,20
e	The centreline-to-centreline spacing of the contacts.	1,27 for tolerances see parameters bbb and ddd
bbb	The tolerance that controls the position of the contact pattern with respect to the horizontal package centreline. The centre of the tolerance zone for each contact is defined by basic dimension e as related to the horizontal package centreline.	0,10
ddd	The tolerance that controls the position of the contacts to each other. The centres of the profile zones are defined by basic dimension e.	0,05

6.2.2.2 Orientation mark for the bottom of the package

An orientation mark, located in the same corner as contact C5, shall be visible on the heat feature. This orientation mark may be a different shape than the one shown in figure 6.2.

6.2.2.3 Orientation mark for top of package

The top of the package shall have an orientation mark located in the same corner as contact C5.

7 Electrical and Logical specifications of the MFF UICC - Terminal interface

7.0 Requirements

For a M2M UICC using MFF1 or MFF2, the following applies:

- Unless otherwise specified in the present specification the MFF shall conform to the electrical specifications of the UICC - Terminal interface as defined in ETSI TS 102 221 [1].
- The use of all contacts shall be as defined in ETSI TS 102 221 [1], ETSI TS 102 600 [4] and ETSI TS 102 613 [3] except as defined below.
- In the case where the MFF does not support the functionality as defined in ETSI TS 102 600 [4] then contacts C4 and C8 shall not be bonded.
- In the case where the MFF does not support the functionality as defined in ETSI TS 102 613 [3] then contact C6 shall not be bonded.
- Unless otherwise specified in the present specification the MFF shall conform to the logical characteristics of the UICC as defined in ETSI TS 102 221 [1].

7.1 Voltage Class support

The M2M module supporting the present document shall not power the UICC using Voltage Class A.

8 Device Pairing Mechanism

8.0 Introduction

The following mechanisms for device paring may be supported:

- Secure Channel pairing.
- CAT application pairing.

For each of the above pairing techniques, the M2M UICC shall decide the level of access that the terminal may have following the operation of the pairing mechanism.

8.1 Secure Channel Pairing

The M2M UICC and terminal may securely pair and communicate by setting up a platform to platform APDU secure channel as described in ETSI TS 102 484 [5].

Where the securing of information is not required, a reduced secure channel procedure may be followed:

- The support for secure channel and the requirement for a platform to platform secure channel shall be set in the ATR.
- There shall be an entry in the endpoints retrieved from the M2M UICC with the terminal application identifiers set to the ASCII encoded string "M2M pairing". If an entry for a platform to platform APDU secure channel exists then this shall take precedence.
- The platform to platform APDU secure channel setup process shall be completed and then terminated by the terminal immediately without any secure data being sent.

8.2 CAT application pairing

The M2M UICC may use CAT (as specified in ETSI TS 102 223 [6]) to retrieve the terminal identity (e.g. IMEI, IMEISV, ESN, MEID, etc.) and to restrict access to UICC files and services as required.

Annex A (informative): PCB layout for the MFF

This annex details a PCB layout that is able to connect any MFF and various MFF sockets to the PCB.

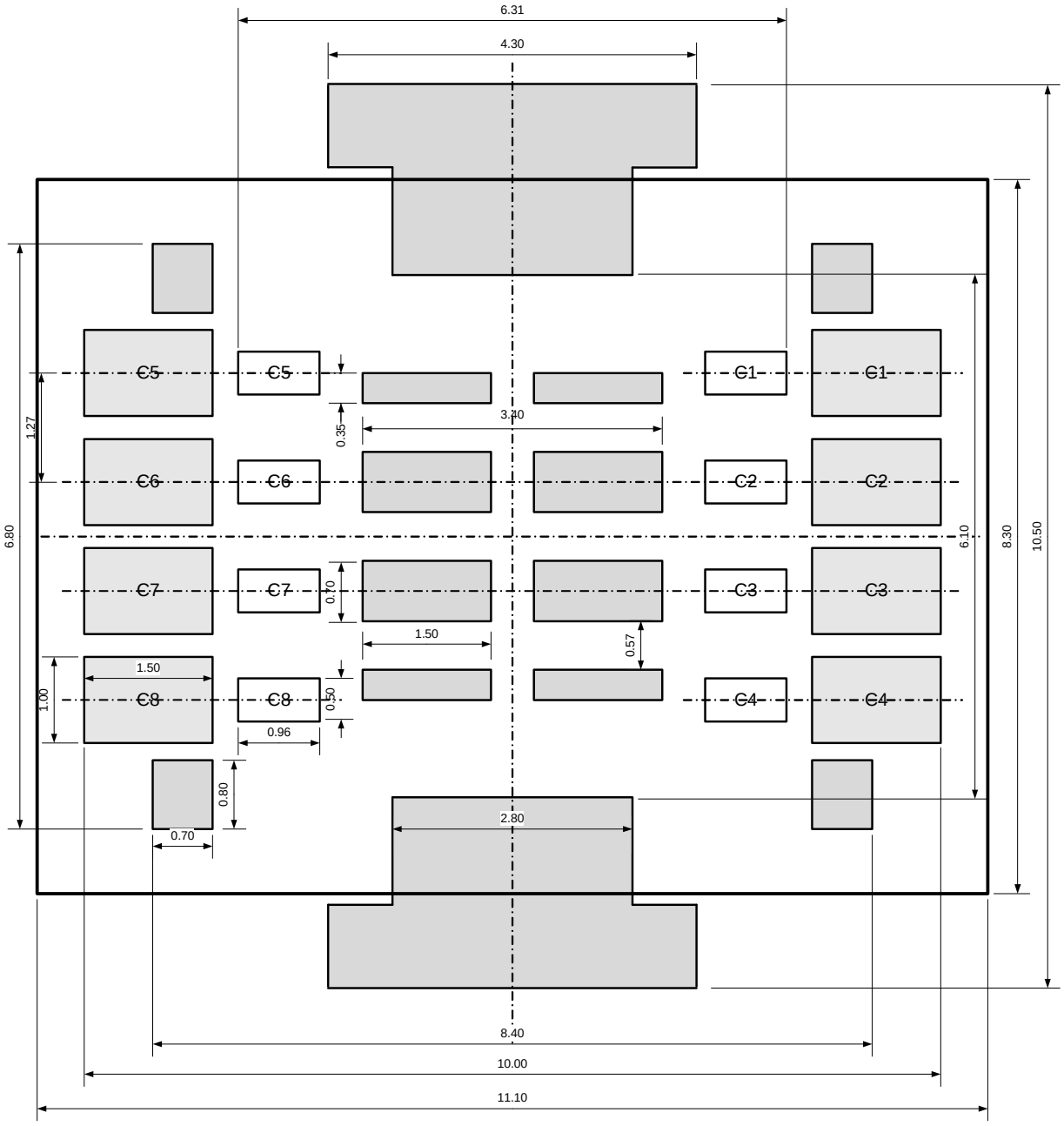

Figure A.1: PCB layout

The inner C1 to C8 pads are the electrical connection points for MFF1 or MFF2.

The outer C1 to C8 pads are the electrical connection points for MFF sockets.

The grey pads in the central area between the C1 to C8 pads are not electrically connected (i.e. they are insulated) and may serve as anchors to reinforce the mechanical attachment of an MFF to the board.

Other grey pads beyond the C1 to C8 area may serve as anchors for MFF sockets.

The rectangular box of 10,50 mm by 11,10 mm in figure A.1 is the recommended clearance zone to accommodate a wide range of MFF sockets. A minimum clearance area of 8,05 mm by 9,00 mm centered at the middle of the contact areas is a minimum to accommodate an MFF socket.

Annex B (informative): Change history

The table below indicates all changes that have been incorporated into the present document since it was placed under change control.

Change history								
Date	**Meeting**	**Plenary Doc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**Old**	**New**
						Creation of the specification		9.0.0
07/2010	SCP #45	SCP(10)0187	001	-	F	Correction of automotive vibration and automotive shock clauses	9.0.0	9.1.0
10/2013	SCP #61	SCP(13)000238r1	002	1	F	Deletion of Fretting Corrosion environmental condition	9.1.0	9.2.0
-	-	-	-	-	-	To comply with ETSI drafting rules: - renumbering of table 5.5.1 to table 5.2 - removal of hanging paragraphs through addition of missing section headers	9.1.0	9.2.0
05/2018	SCP#62	SCP(14)000034r1	003	1	B	Addition of a possibility to store and retrieve M2M UICC environmental classes	9.2.0	12.0.0
07/2018						Editorial update in clause 5.2: value '2Fxx' changed to '2F07' in table 5.1a	12.0.0	12.0.1

History

Document history		
V12.0.0	July 2018	Publication
V12.0.1	July 2018	Publication