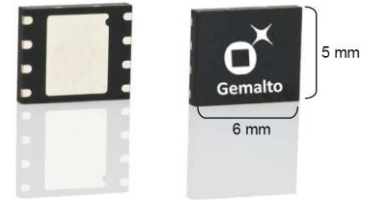


Integration Sheet

About

Desineo Wearable Embedded Module

Company name	Gemalto
Product Name	Desineo Wearable Embedded Module
Document version & Release date	Version 1.00 03-Mar-2016



Production step	Name & Location
Front-End Manufacturing	NXP (Hamburg, Germany)
Assembly	UTAC Thai Ltd (Bangkok, Thailand)
Personalization + Final Test	Gemalto (Shanghai, China)



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Table of contents

1	INTRODUCTION.....	3
2	HISTORY AND EXTERNAL REFERENCES	3
3	ABBREVIATIONS AND DEFINITIONS	3
4	PRODUCT DESCRIPTION	3
5	PRODUCT CHARACTERISTICS	4
5.1	Component main characteristics.....	4
5.2	Pinout.....	4
5.2.1	Contactless interface only.....	4
5.2.2	Contactless & ISO 7816 interfaces.....	4
5.2.3	Pins description.....	5
5.3	Package dimensions	5
5.4	Component Marking.....	6
5.4.1	Layout.....	6
5.4.2	General requirements:.....	6
5.4.3	Special requirements	6
6	PCB DESIGN RECOMMENDATIONS.....	7
6.1	Basic design recommendations	7
6.2	PCB footprints recommendations	7
6.3	Central pad soldering.....	8
6.4	Solderability.....	8
6.5	Unused pins configuration.....	8
7	SOLDERING GUIDANCE	9
7.1	Component Placement and Alignment.....	9
7.2	Solder paste.....	9
7.3	Reflow.....	9
7.4	PCB cleaning.....	10
7.5	Solder joint inspection	10
8	HANDLING RECOMMENDATIONS	11
8.1	Warehousing conditions.....	11
8.2	ESD protective measures	11
8.3	Moisture	11
8.4	Rework	11
9	PRODUCT DELIVERY	12
9.1	Packing	12
9.1.1	General Characteristics	12
9.1.2	Reel presentation.....	13
9.1.3	Carrier Tape.....	14
9.1.4	Cover Tape	14
9.1.5	Reel.....	15
9.1.6	Protective tape.....	16
9.1.7	Moisture Barrier Bag.....	16
9.1.8	Desiccant and Humidity indicator	17
9.1.9	Electrostatic Sensitive Device and Moisture Sensitive Device indications	17
9.1.10	Packing box	18

1 Introduction

The objective of this document is to provide technical information related to Gemalto Desineo product packaged in MFF2 form factor (DFN package).

It details the information needed for the product integration into the final device. Such information are part of the global product approval.

2 History and external references

REVISION	DATE	DESCRIPTION
1.00	03-Mar-2016	Initial release.

REFERENCE	NAME
[RE1]	ETSI TS 102.221: Smart Cards; UICC-Terminal interface; Physical and logical characteristics
[RE2]	ISO 7816-3 ; Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols
[RE3]	ETSI TS 102.671, April 2010: Machine to Machine UICC; Physical and logical characteristics
[RE4]	IPC/JEDEC J-STD-033B.1, January 2007: Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

3 Abbreviations and definitions

DFN	Dual Flat No-lead package
ESD	ElectroStatic Discharge
HIPS	High-Impact Polystyrene
MFF2	M2M Form-Factor 2; The [RE3] ETSI standardized M2M SMD form-factor (also known in the industry as VQFN-8, SON-8 or DFN-8)
MSL	Moisture Sensitivity Level
SMD	Surface Mounted Device

4 Product description

Gemalto MFF2 module combines traditional smart card security with a more rugged form factor; it is designed to allow direct soldering of the on device's printed circuit board.

This component has a specific form factor of DFN-8 with a size of 5x6mm, defined as MFF2 in [RE3].

5 Product characteristics

5.1 Component main characteristics

Packaging	[RE3]
Size	6 mm x 5 mm
Operating temperature	-25 to +85°C
Storage temperature	5°C to 40°C
Supply voltage	Supports ISO class B.
Communication protocol	T=0 over ISO 7816 ACLB over La, Lb pins
Electrical characteristics	[RE2]
MSL level	1

5.2 Pinout

Depending on the final use case, the component pin layout is compliant to the following figures.

5.2.1 Contactless interface only

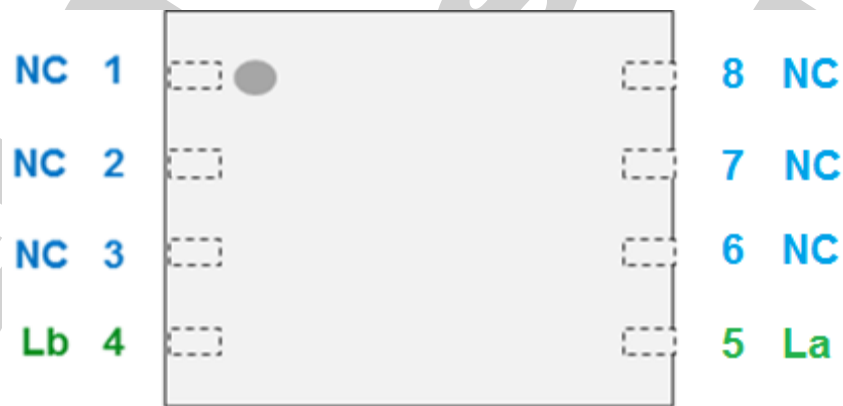


Figure 1. Pinout - Contactless only (top view)

5.2.2 Contactless & ISO 7816 interfaces

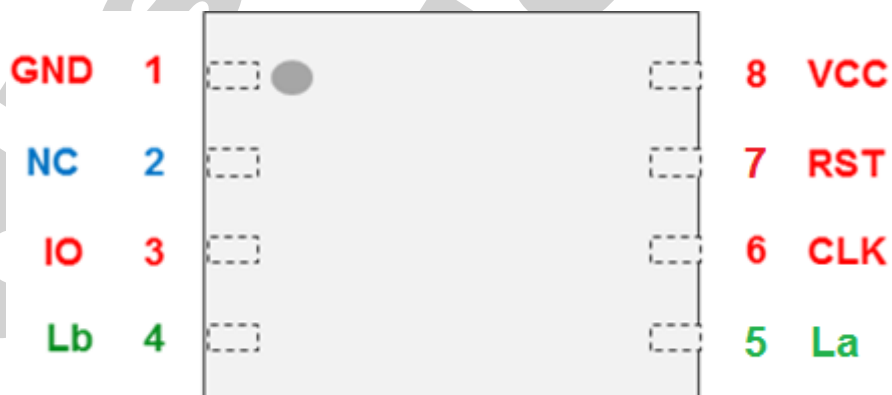


Figure 2. Pinout – Contactless + ISO7816 (top view)

5.2.3 Pins description

ISO 7816 interface

- VCC: Power supply
- GND: Ground
- RST: Reset input (active low)
- CLK: Clock input
- IO: Serial input/output data

Contactless interface

- La and Lb pins are used for the RF communication (ACLB interface).
- These pins are aimed to be directly connected to the RF antenna.

5.3 Package dimensions

Component is 0.9 mm thickness, total 27 mm³ (0.9 x 5 x 6). Package dimensions are compliant with [RE3]

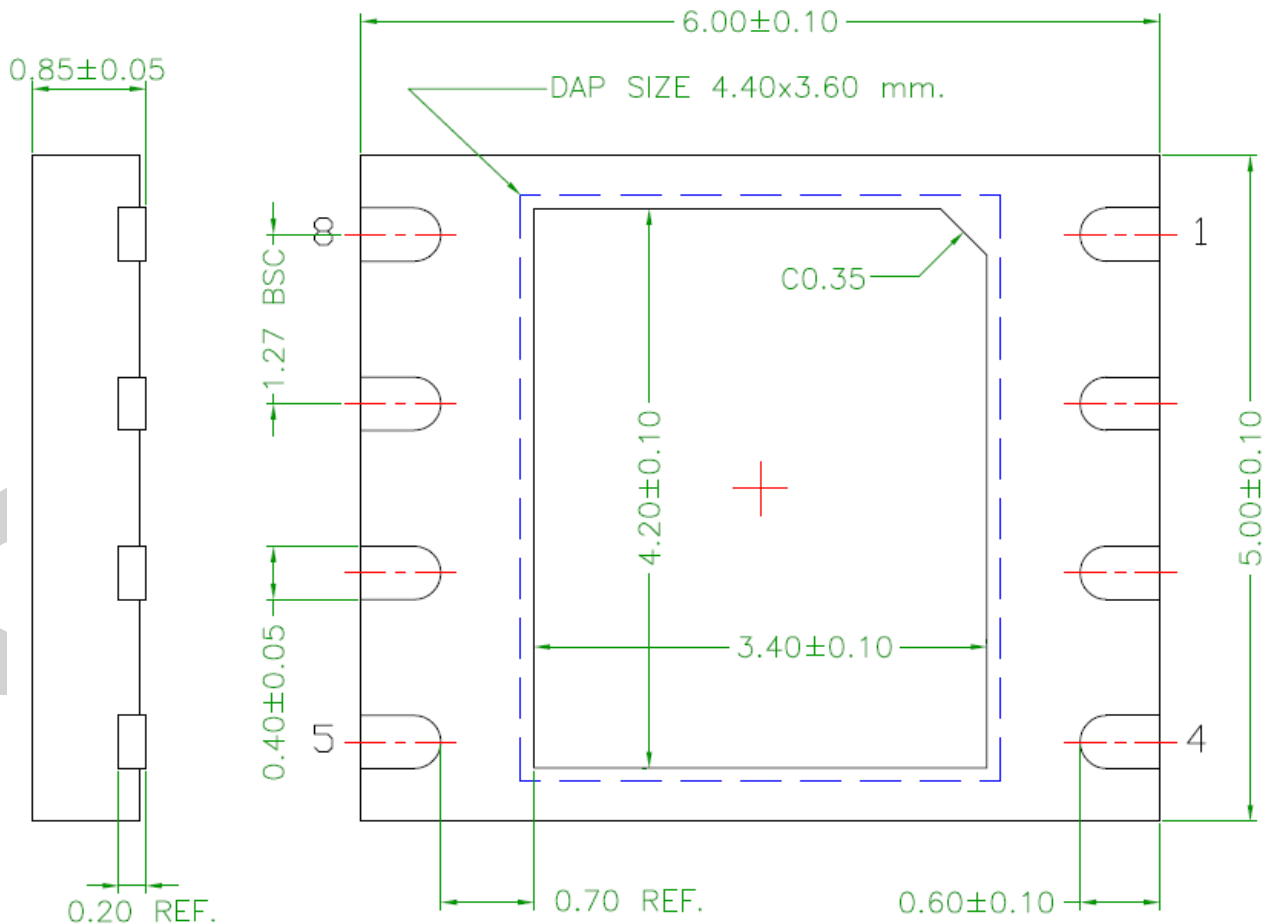
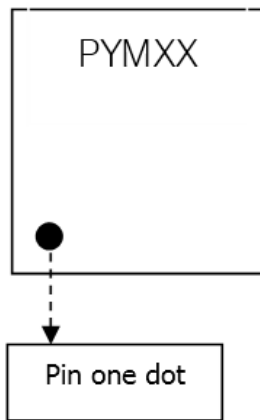


Figure 3. Package dimensions

5.4 Component Marking

5.4.1 Layout



Line 1: Supplier internal marking

Lines 2-4: Blank line

Line 5: Pin one dot

5.4.2 General requirements:

Type of marking	Top Mark
Character height : mils	30+/-5
Line spacing : mils	N/A
Max. line	2
Max. characters per line	Line 1: 5 char. Line 5: Pin one dot only
Marking alignment	Center justified
Pin one dot size : mils	10+/-5

5.4.3 Special requirements

Marking layout dimensions

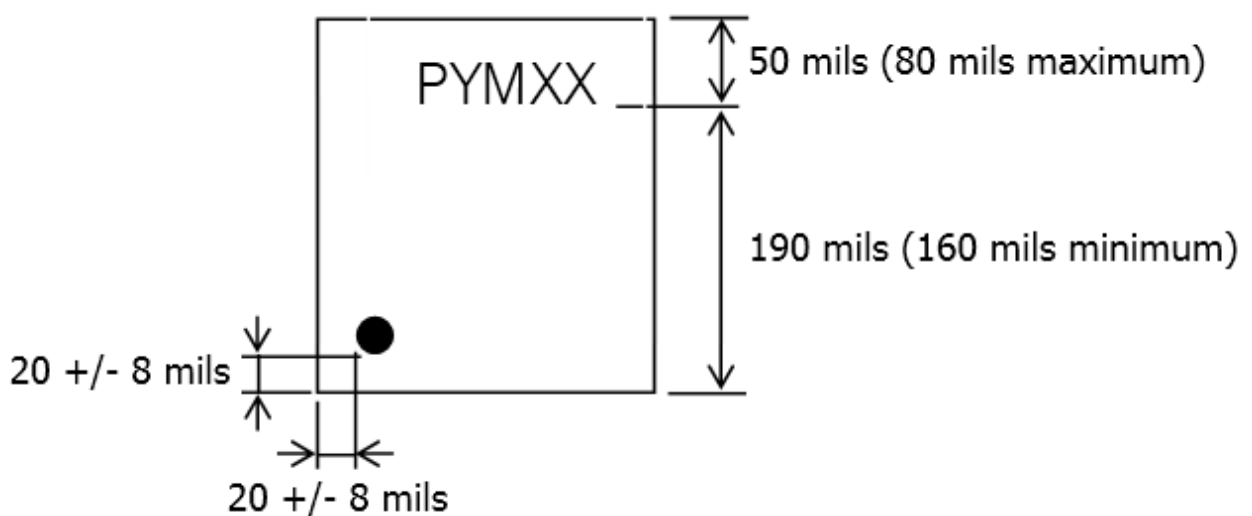


Figure 4. Marking dimensions

6 PCB design recommendations

6.1 Basic design recommendations

The PCB board design, solder, printing and soldering process need special attention to ensure good solder joint and no solder bridging.

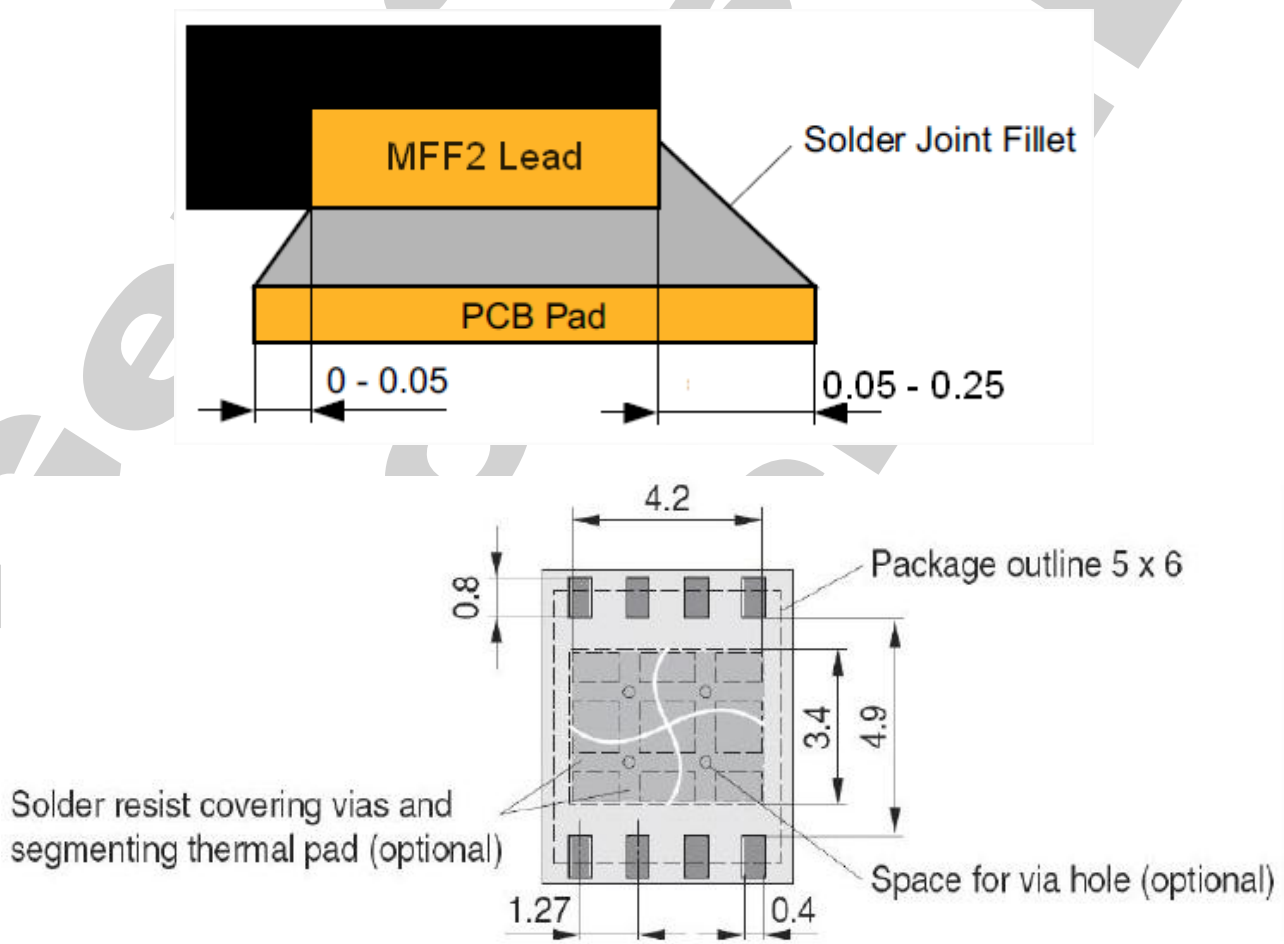
Before assembly, it shall be ensured that the PCB meet the followings:

- Design requirements compliant to IPC-D-275
- Flatness shall be within 0.1mm per linear centimeter
- Conform to the solderability requirements given in ANSI/J-STD-003

6.2 PCB footprints recommendations

This describes our recommendations in terms of the printed circuit board landing pattern for this DFN component.

For PCB design we recommend to extend the pad by 0.05 to 0.25 mm compared to the package land in direction of package outside. This extension of the PCB pad helps to develop a solder joint fillet at the side wall of the VQFN land. This recommendation has been taken into account in the below PCB layout.



6.3 Central pad soldering

The central pad of the MFF2 package can be soldered to the PCB (recommended) in order to have a maximum resistance and also to help heat dissipation.

Vias holes can be done on the PCB under the central pad to maximize heat dissipation. Typical thermal vias have the following dimensions :

- Via diameter = 0.25mm to 0.35mm.
- Via Pitch = 1.0mm to 1.2mm.

Note that during reflow process, solder can flow through the vias causing solder wicking. So it becomes essential that the vias be plugged. The treatment of via can be applied in several techniques in order to prevent solder wicking and void developing during reflow process :

1. via tenting with solder mask
2. via plugging with liquid photo-imagable (LPI) solder mask
3. via encroaching

The central pad is also recommended to be connected to the ground plan of the PCB.

6.4 Solderability

Gemalto's MFF2 package has the following characteristics regarding solderability :

- MSL3 package (according to Jedec J-STD-020, 168h floor time at ambient temperature/humidity)
- Ni/Pd/Au/Ag PPF plating
- Maximum reflow temperature: 260°C
- Lead free packing compliant to the European Directive for Restriction of Hazardous Substances (RoHS).

6.5 Unused pins configuration

Depending on the use case, ISO 7816 pins may not be used.

In this case, the pins connection requirement is: all the unused pins shall be let floating (unconnected).

As in this configuration, the product is used in pure contactless mode, the requirement is not only valid for ISO group pins but also for VCC and GND pins.

In other words, this requirement applies to all package pins except La and Lb.

No external pull-up or pull-down resistor need to be attached to ISO pins. The chip already has weak (~300 kOhm) internal pull-ups on IO and RST, and an adaptive pull-up/pull-down on CLK.

7 Soldering guidance

7.1 Component Placement and Alignment

During reflow, if the components are not placed and aligned precisely electrical shorts created from solder bridging can be found. Components having a misalignment exceeding 50% of pad center must be realigned prior to reflow process.

7.2 Solder paste

Solder paste consists of solder alloy and a flux system. One of the functions of the flux system is to remove the contaminations from the solder joints during the soldering process. A lead-free solder paste metal alloy composition (typically SnAgCu) can be applied; a “no-clean” solder paste is preferred, because cleaning under the soldered MFF2 may be difficult. The paste must be suitable for printing the solder stencil aperture dimensions. Type 3 paste (ref: J-STD-005) is recommended. Solder paste is sensitive to storage time, temperature and humidity. Please notice the handling recommendations of the paste manufacturer.

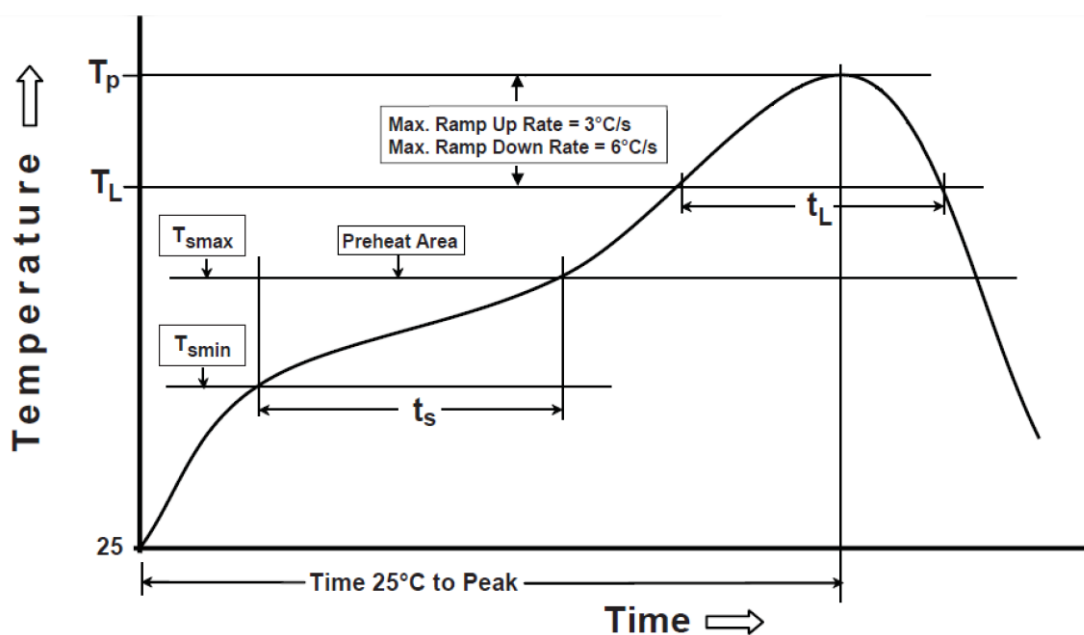
7.3 Reflow

Soldering determines the yield and quality of assembly fabrication to a very large extent. Generally all standard reflow soldering processes (forced convection, vapor phase, infrared (with restrictions)) and typical temperature profiles are suitable for board assembly of the MFF2.

Wave soldering is not possible.

At the reflow process, each solder joint has to be exposed to temperatures above solder liquidous for a sufficient time to get the optimum solder joint quality, whereas overheating the PCB with its components has to be avoided. When using infrared ovens without convection, special care may be necessary to assure a sufficiently homogeneous temperature profile for all solder joints on the PCB, especially on large, complex boards with different thermal masses of the components, including those under the MFF2.

The most recommended type is forced convection reflow.



	Pb-Free Assembly
Preheat/Soak	
Temperature Min (T _{smin})	150 °C
Temperature Max (T _{smax})	200 °C
Time (t _s)	60-120 s
Liquidous temperature (TL)	217°C
Time (t _l)	60-120s
Peak temperature (T _p)	250°C
Time 25 °C to peak temperature	8 minutes max.

Figure 5. Reflow profile

7.4 PCB cleaning

If the no-clean solder paste and flux are applied, the PCB cleaning is not necessary since there are no hazardous residues left on the board. It can be definitely sure that some types of no-clean solder paste may not be satisfyingly free from contamination on the final board so UTL highly recommended that the experiment should be executed to examine whether eventually the residue is required to eliminate.

7.5 Solder joint inspection

The 2D or 3D techniques is required to measure the volume of solder plated on PCB. The solder voids, solder ball, solder bridging, short, open and other defects should be inspected in several transmission type X-Ray equipment after re-flowing the mounted package. Automated optical inspection (AOI) is one of recommended X-Ray machine. Additionally, the fillet shape, size, and joint standoff height can be verified by cross-sectioning.

8 Handling recommendations

8.1 Warehousing conditions

Here are the recommended conditions for product storage:

- Temperature between 5°C and 40°C (ideally 23° +/- 5°C).
- Humidity between 30 and 60 %
- 12 months from delivery date

8.2 ESD protective measures

Semiconductor devices are electrostatic discharge sensitive devices requiring specific precautionary measures regarding handling and processing. Discharging of electrostatic charged objects over an IC, caused by human touch or by processing tools may cause high current / high voltage pulses, which may damage or even destroy semiconductor structures. On the other hand ICs may also be charged during processing. If discharging takes place too quickly ("hard" discharge), it may cause load pulses and damages. ESD protective measures must therefore prevent a contact with charged parts as well as a charging of the ICs. Protective measures against ESD include the handling, processing and packing of devices.

8.3 Moisture

Soldering process of Surface Mounted Devices (SMD) requires packages to be moisture free. Presence of moisture in the package can cause irreversible damages to the device (pop corn effect or even not visible damages) during temperature peaks induced by soldering process. MSL3 packages are moisture sensitive packages with 168h floor life at maximum 30°C / 60% relative humidity.

For more details, see applicable specification : Jedec J-STD-020

8.4 Rework

SMD packages provided by Gemalto are not designed to be processed several times; after a package has been soldered on the printed circuit board, if it is removed then mounted again, on the same board or a new one, Gemalto disclaims any responsibility in case of malfunction.

9 Product delivery

9.1 Packing

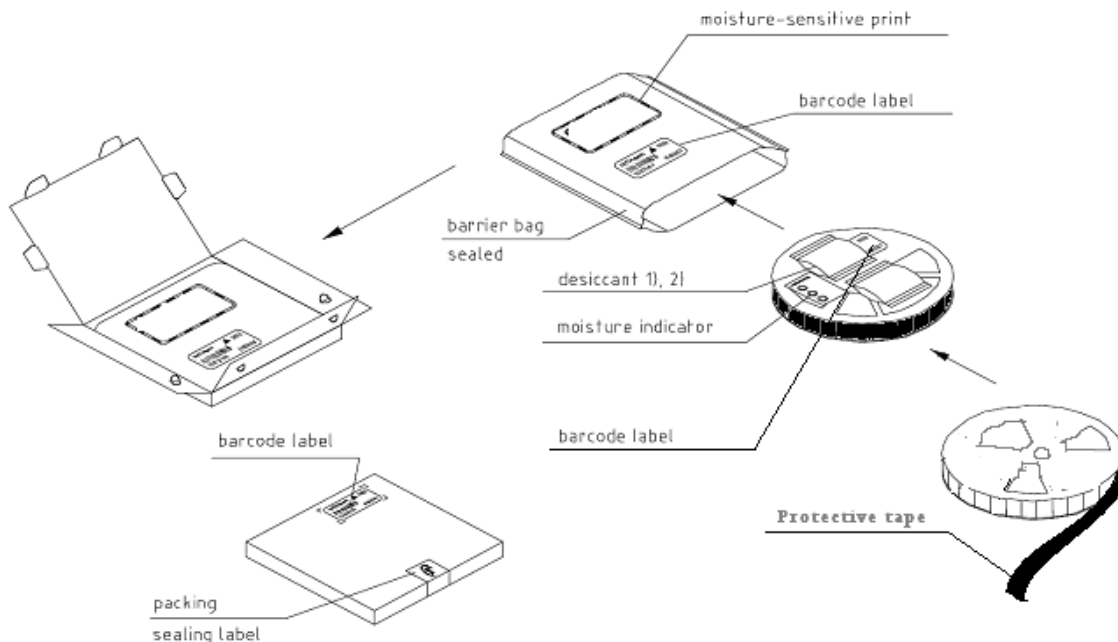
This section describes Gemalto general rules for the packing of MFF2 components. It includes general description of parts involved: reels, carrier tape, cover tape, moisture barrier bag, desiccant, humidity indicator card and identifications. It describes the conditioning Gemalto supplies to customers.

The packing meets handling and shipping requirements of [RE4]. This section is established for users of Gemalto's tape & reel packing.

9.1.1 General Characteristics

9.1.1.1 Packing presentation

Tape & reel packing aims to protect chips and allows an automated handling of electronics devices. It is constituted of various elements and assembled as shown in the figure below.



9.1.1.2 Quantity of components per reel

2 types of reels exist for MFF2, small reels (Ø 180mm) for 500 to 1000 pcs, and large reels (Ø 330mm) for 1000 to 3000 pcs.

	Small reel	Large reel
Reel diameter	180 mm	330 mm
Min qty	500	500*
Max qty	1000	3000

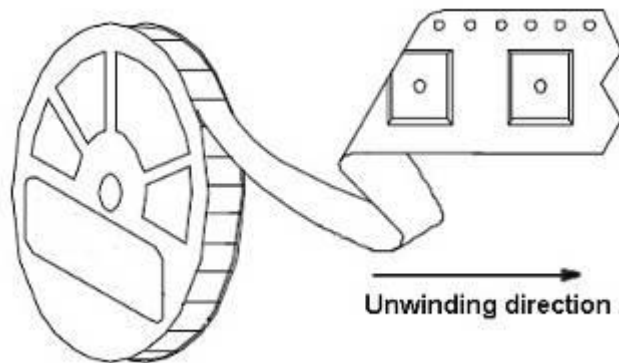
* Note that with less than 1000 pcs, it can happen that the large reel is permanently deformed during hermetic sealing, that's why it is highly recommended to use small reels for small quantities, which is the default proposed by Gemalto.

9.1.1.3 Products Identification

Required product identification is printed on sticker labels. Labels are stuck on the packing box, the moisture barrier bag and the reel.

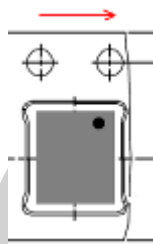
9.1.2 Reel presentation

9.1.2.1 Unwinding direction

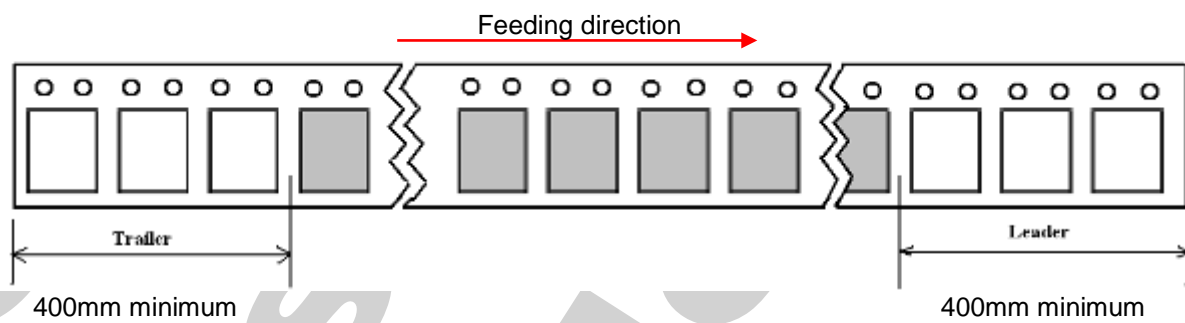


9.1.2.2 Component orientation

The Pin #1 index mark is on the perforation side, right.

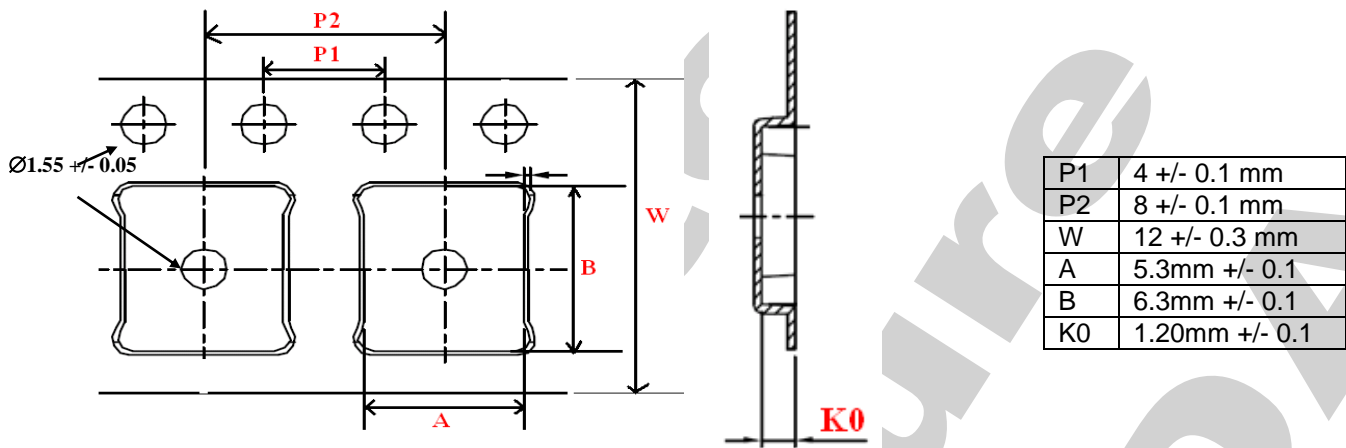


Leader & Trailer Length



9.1.3 Carrier Tape

9.1.3.1 Dimensions



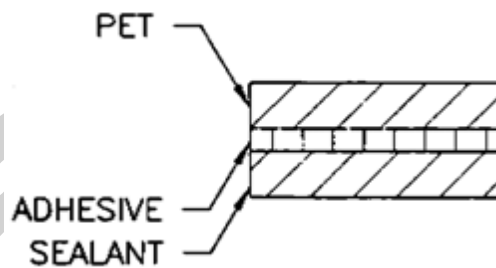
9.1.3.2 Material

- Polystyrene
- Recyclable plastic
- ESD protective

9.1.4 Cover Tape

Hot sealing tape with peel force strength at 180°, speed 300 mm/min: Average value between 0.3 and 0.9 N.

9.1.4.1 Material



- Transparent polyester film
- Anti-static

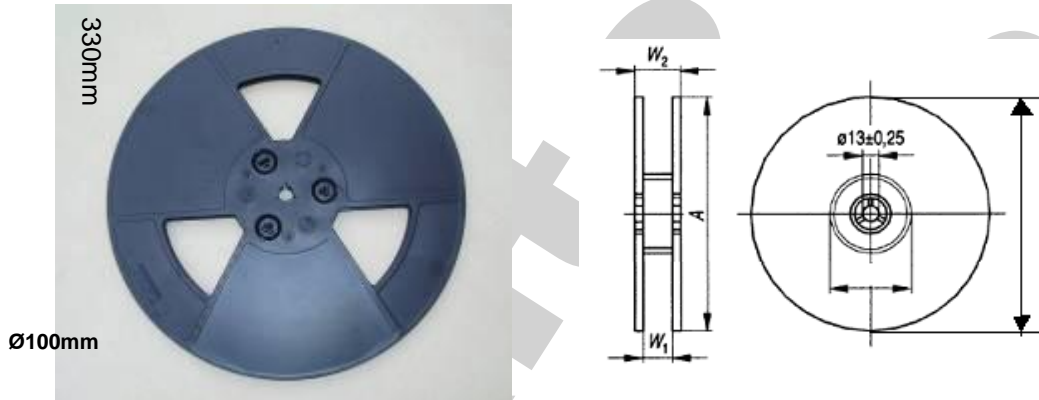
9.1.4.2 Dimension

- Width: carrier 9mm
- Thickness: 0.04 to 0.06 mm

9.1.5 Reel

9.1.5.1 Large reels

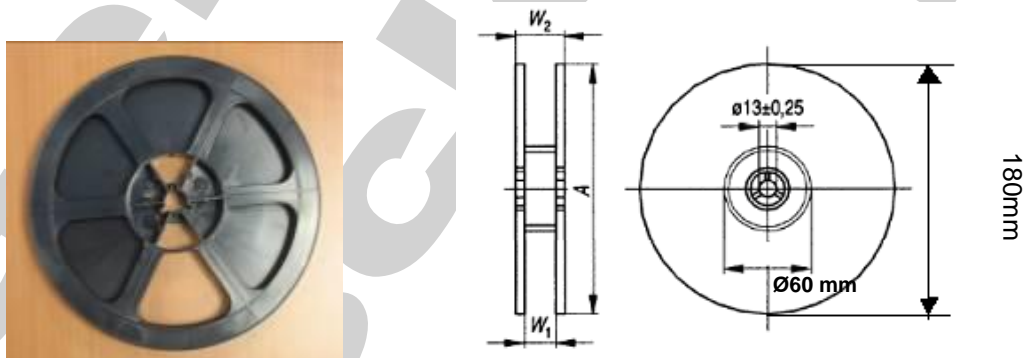
330 mm diameter reels are used for standard quantities.



- First turn diameter: 100 mm minimum (4")
- External diameter : 330 mm (13")
- W1 width: typical value 12.4 mm
- W2 : 16,5mm max

9.1.5.2 Small reels

180 mm diameter reels are used for smaller quantities.



- First turn diameter: 60 mm minimum
- External diameter : 180 mm (7")
- W1 width: typical value 12.4 mm
- W2 : 16,5mm max

9.1.5.3 Material

- Polystyrene
- Recyclable plastic: recyclable symbol on the reel
- ESD protective



9.1.6 Protective tape

The protective tape is wound up outside the last turn of the carrier tape to protect it from mechanical damage.
Material : HIPS

9.1.6.1 Dimensions

- Width: 12mm.
- Length: 1100mm min
- Thickness: 0.5mm min

9.1.7 Moisture Barrier Bag

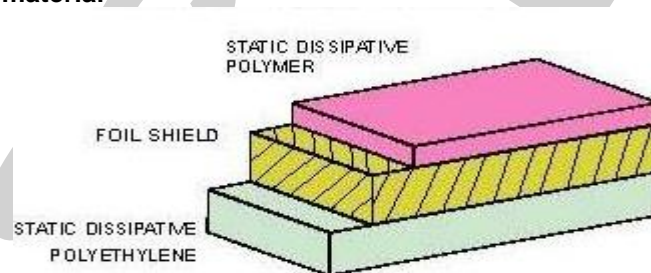
Reels are placed into an anti-static moisture barrier bag with 1 humidity indicator card and 2 desiccant units.
The bag is hot sealed with a light air evacuation (vacuum).



9.1.7.1 Dimensions

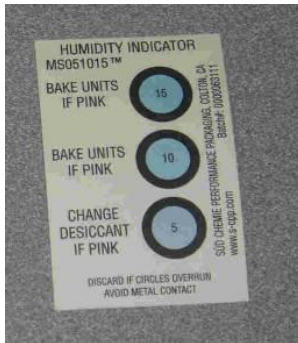
Typical value: 48 x 43 cm

9.1.7.2 Structure and material



9.1.8 Desiccant and Humidity indicator

In the moisture barrier bag, 1 humidity indicator and 2 desiccant bags are placed for reels 330mm. 1 humidity indicator and 1 desiccant bag are placed for reels 180mm.



Humidity indicator



Desiccant bag

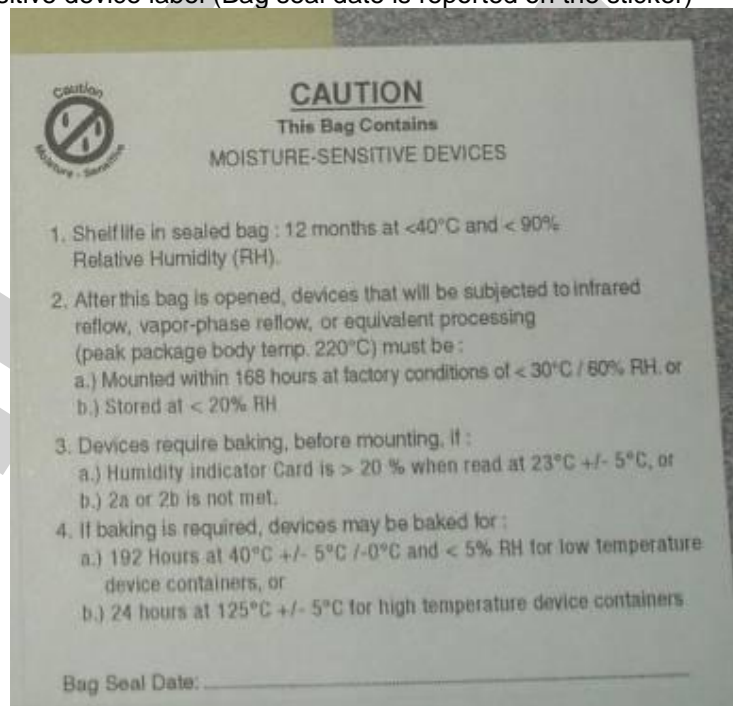
9.1.9 Electrostatic Sensitive Device and Moisture Sensitive Device indications

On the moisture barrier bag, electro sensitive device and moisture sensitive device labels are stuck. Labels or printed information can be used. See pictures hereafter.

- Electro sensitive Device label



- Moisture Sensitive device label (Bag seal date is reported on the sticker)



9.1.10 Packing box

9.1.10.1 Dimensions

Typical Box size: 370 x 350 x 60 mm
1 reel per box

9.1.10.2 Type 1: Cardboard

Cardboard packing box (not compatible for use in clean rooms)



Sticker for cardboard box closing.

9.1.10.3 Type 2: Polypropylene

Packing box in polypropylene are compatible with use in clean rooms.



Sticker for polypropylene box closing.

- END OF DOCUMENT -