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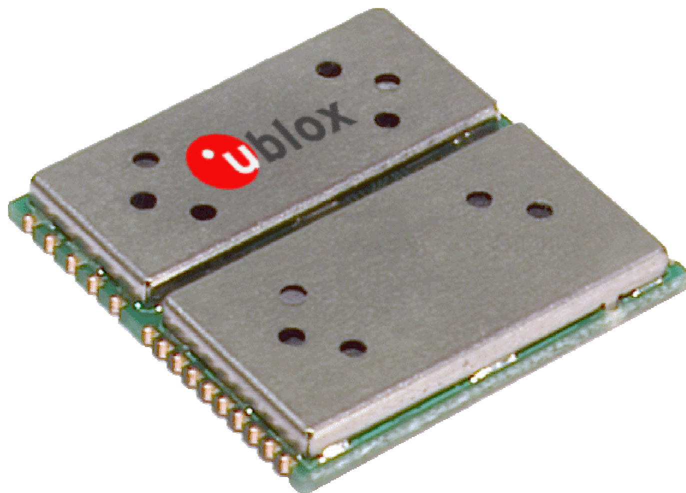
TIM GPS Macro-Component Handling and Soldering

Application Note



This application note describes the recommendations for the processing and handling of the TIM GPS receiver macro-component. Readers are advised that the responsibility over the actual manufacturing process and process quality control lies at their contracted electronic manufacturer.

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Application Note

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1 Packaging

The TIM macro-components are delivered as reeled tapes in order to enable efficient production, production lot set-up and tear-down.

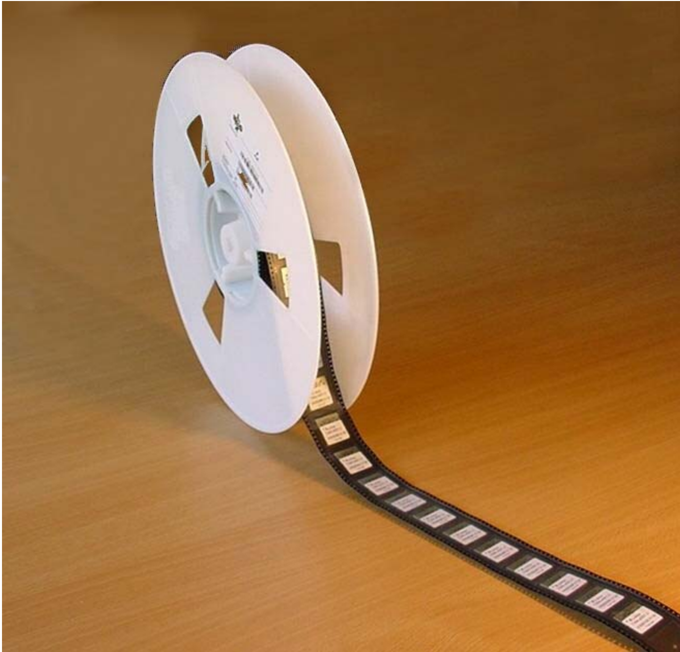


Figure 1-1: Reeled TIM macro-components

1.1 Reels

The TIM GPS receiver macro-components are available in two reel sizes. A 100pcs reel and a 500pcs reel. The dimensions of both reels are identical:

Diameter: 330mm

Width: 44mm

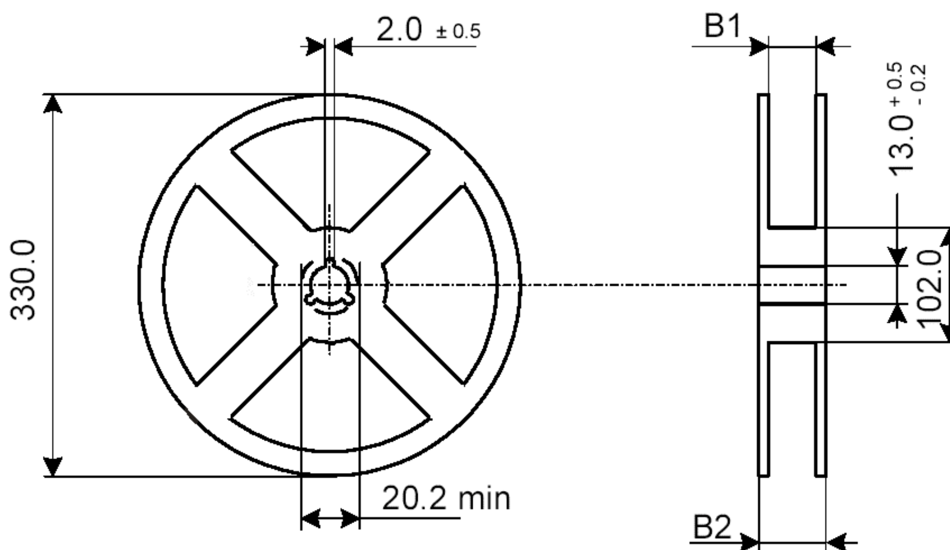


Figure 1-2: Reel - dimensions

1.2 Tapes

The tape is specified in the figure below. Units are in mm.

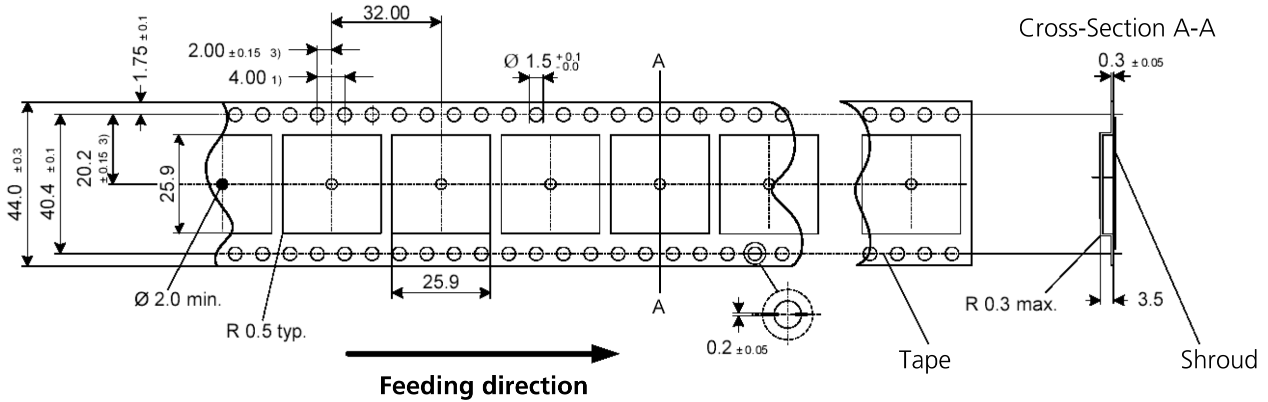


Figure 1-3: Tape - dimensions

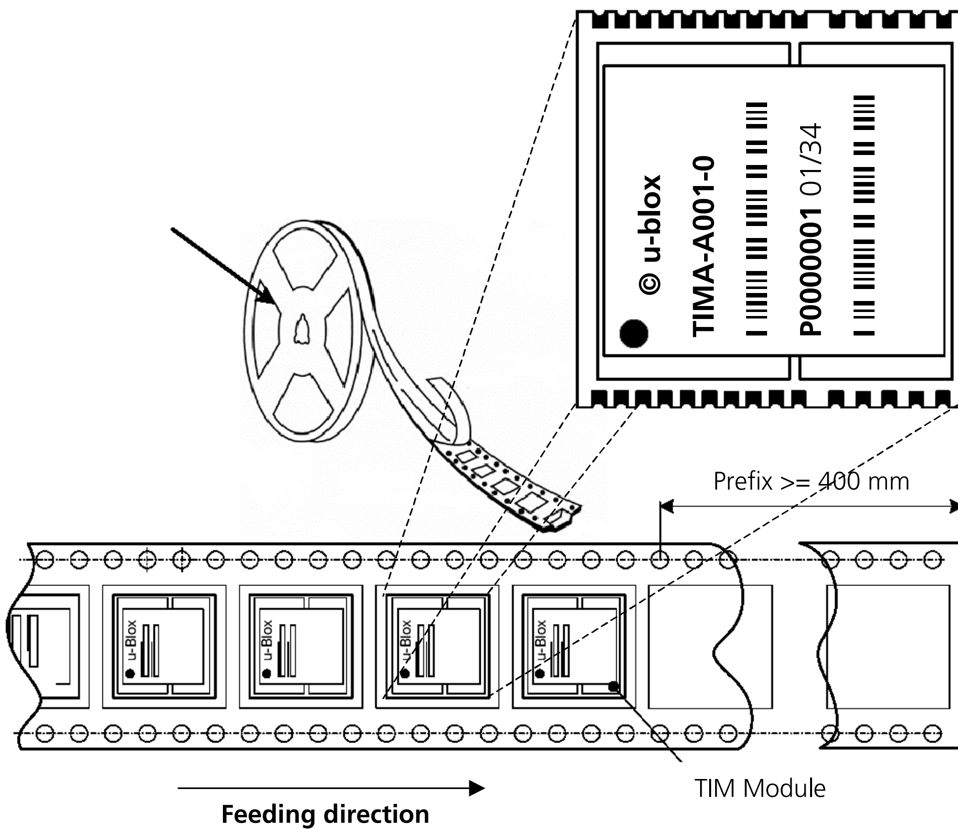


Figure 1-4: Reel - orientation of TIM macro-components in relation to feed direction

2 SHIPMENT, STORAGE AND HANDLING

2.1 Handling

The TIM macro-component is designed and packaged to be processed in an automatic assembly line. The TIM macro-component is shipped in Tape-and-Reel. These Tape-and-Reel packages are sealed to protect the parts from exposure to moisture and Electro-static discharge (ESD).

Caution:

The component contains highly sensitive electronic circuitry. Handling the TIM GPS receiver without proper ESD protection may destroy or damage the TIM macro-components permanently.

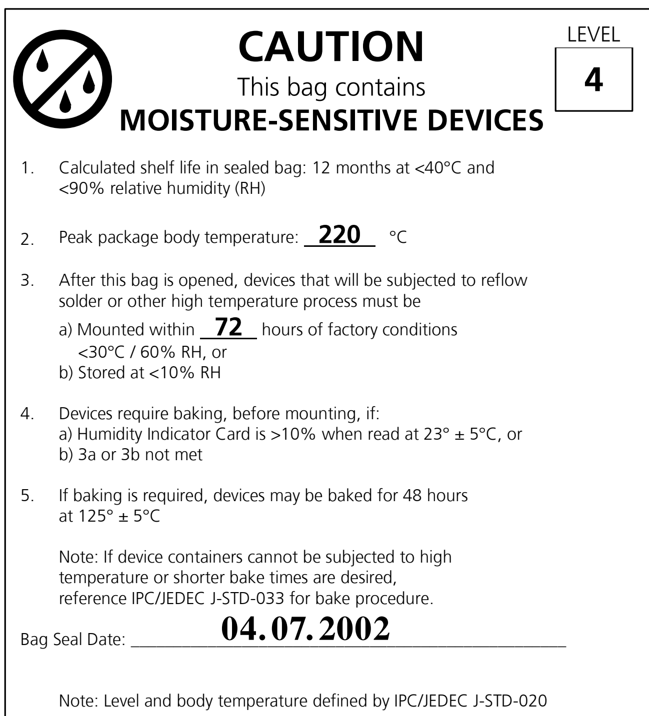
Caution:

According to JEDEC ISP, the TIM macro-components are **Moisture Sensitive Devices**. Appropriate handling instructions and precautions are summarized in sections 2.2 - 2.5. They must be considered to prevent permanent damages due to moisture intake.

2.2 Shipment

The TIM macro-components are delivered on Tape-and-Reels in a hermetically sealed package ("dry bag") to prevent moisture intake and protection against electrostatic discharge. To prevent physical damages, the reels are individually packed in 'pizza boxes'.

The dry bag provides a JEDEC compliant MSD label (Moisture Sensitive Devices) describing the handling requirements to prevent humidity intake.



CAUTION

This bag contains

MOISTURE-SENSITIVE DEVICES

LEVEL **4**

1. Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)
2. Peak package body temperature: **220** °C
3. After this bag is opened, devices that will be subjected to reflow solder or other high temperature process must be
   a) Mounted within **72** hours of factory conditions <30°C / 60% RH, or
   b) Stored at <10% RH
4. Devices require baking, before mounting, if:
   a) Humidity Indicator Card is >10% when read at 23° ± 5°C, or
   b) 3a or 3b not met
5. If baking is required, devices may be baked for 48 hours at 125° ± 5°C

   Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure.

Bag Seal Date: **04.07.2002**

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

Figure 2-1: Applicable MSD Label (See section 3.1 for baking instructions)

2.3 Storage

Shelf life in sealed bag is 12 months at <40°C and <90% relative humidity.

2.4 Handling

A Humidity Indicator Card and a desiccant bag to absorb humidity are enclosed in the sealed package. The parts are shipped on Tape-and-Reel in a hermetically sealed package. If no humidity has been drawn, the three fields in the Humidty Indicator Card indicate blue color.

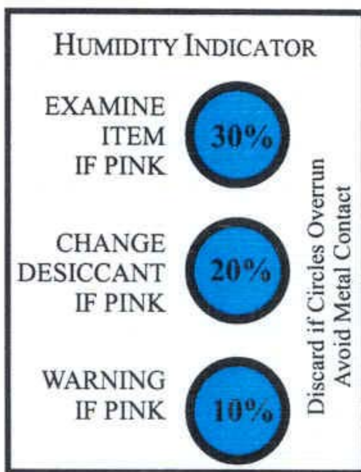


Figure 2-2: Humidity Indicator Card, good condition

2.5 Floor Life

For products with moisture sensitivity level 4, the floor life is 72 hours, or precisely three days. Under factory floor temperature and humidity conditions (<30°C, <60° relative humidity), the parts must be processed and soldered within this specified period of time.

Once the sealed package of the reel is opened and the parts exposed to humidity, they need to be processed within 72 hours (precisely three days) in a reflow soldering process. If this time is exceeded, or the sticker in the sealed package indicates that the goods have been exposed to moisture, the devices need to be pre-baked. Please refer to chapter 3 for instructions on how to pre-bake the components.

3 PROCESSING

3.1 Moisture Preconditioning

Both encapsulant and substrate materials absorb moisture. JEDEC specification J-STD-020 must be observed to prevent cracking and delamination associated with the "popcorn" effect during solder reflow. The popcorn effect is described as miniature explosions of evaporating moisture. Baking before processing is required in following cases:

- Humidity Indicator Card: At least one circular indicator is no longer blue
- Floor life has been exceeded or environmental requirements after opening the seal has been opened, e.g. exposure to excessive seasonal humidity.

Recommended baking procedure:

Duration: 48 hours

Temperature: 125°C

Humidity: Below 5%. Desiccant must be placed into the oven to keep humidity low.

Oven: Convection flow oven. Also put desiccant pack into the oven for dehydration.

Afterwork: Put baked components with desiccant and moisture indicator into a humidity proof bag and use a vacuum hot barrier sealing machine for sealing if not processed within specified floor time. Storage in a nitrogen cabinet or dry box is a possible approach to prevent moisture intake.

Caution:

Do not attempt to bake the TIM macro-components contained in tape and rolled up in reels with 125°C for 48 hours. This baking process will destroy the reels, tapes and most likely the macro-components, too.

If you need to bake the TIM macro-components, remove them from the belt and place them individually onto the oven tray.

Advice:

Repeated baking reduces the wetting effectiveness of the pad contacts. This advice applies to all SMT devices.

3.2 Soldering Paste

Use of "No Clean" Soldering paste is strongly recommended, as it does not require cleaning after the soldering has taken place. The paste listed in the example below meets this criterion.

Soldering Paste: Ecorel 802 http://www.promosol.com/english/cremes01a.html

Alloy specification: Sn62Pb36Ag2 (62% Zinc / 36% Lead / 2% Silver) Paste without Silver (63% Zinc / 37% Lead) also works.

Liquidus Temperature: 183°C or lower

Stencil Thickness: ≥ 150 µm for base boards

The final choice of the soldering paste depends on the approved manufacturing procedures.

Advice:

The quality of the solder joints on the connectors ('half vias') should meet the appropriate IPC specification.

3.3 Footprint

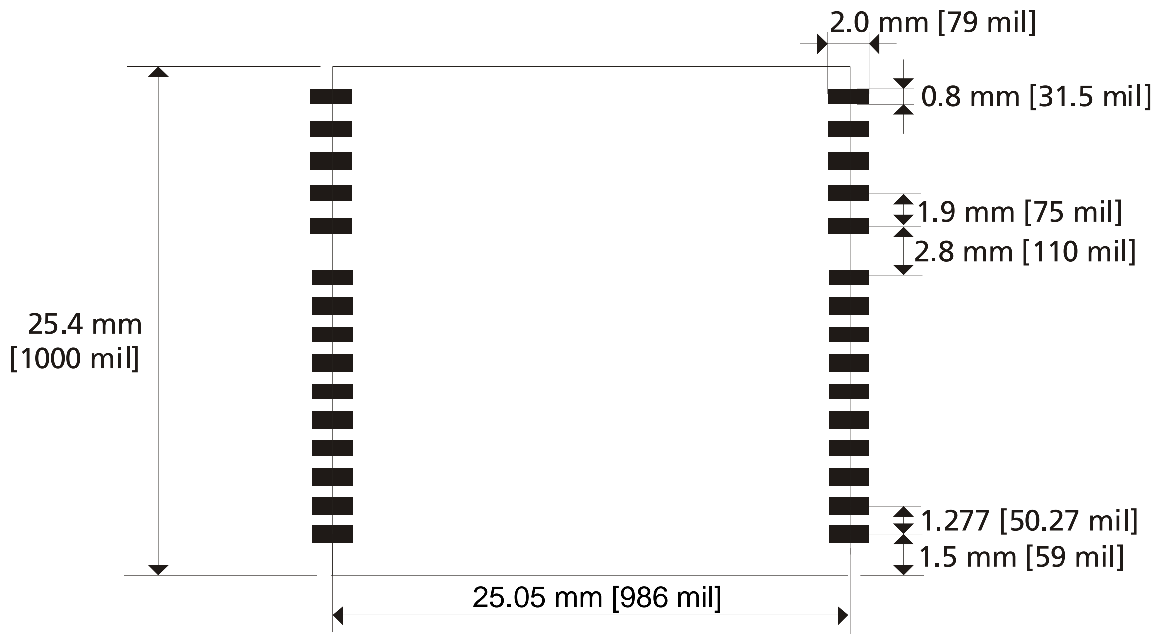


Figure 3-1: Recommended footprint

3.4 Paste Mask

To improve the quality of the soldering, define the length of the paste mask 0.4mm [16mil] bigger than the pad length of the copper mask. The recommended thickness of the paste mask should be 150µm [6mil].

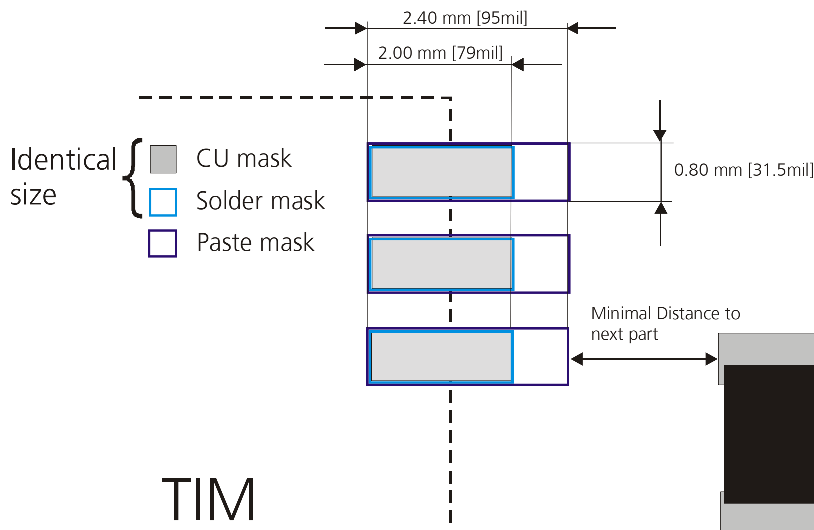


Figure 3-2: Recommendations for solder and paste mask

Caution:

Consider the paste mask outline when defining the minimal distance to the next part.

3.5 Reflow Soldering

A convection type soldering oven is strongly recommended over the infrared type radiation oven. Convection heated ovens allow precise control of the temperature and all parts will heated up evenly, regardless of material properties, thickness of components and surface color.

Consider the "IPC-7530 Guidelines for Temperature Profiling for Mass Soldering (Reflow and Wave) Processes, published 2001" [2].

Preheat Phase:

Initial heating of component leads and balls. Residual humidity will be dried out. Please note that this preheat phase will not replace prior baking procedures.

Temperature rise time: 1 - 3°C/s

Reach 100 - 125°C

Activation Phase:

The solder paste dries out and the flux activates. The activation phase is normally dependent on your chosen soldering paste and is therefore subject to variations.

Ramp up from 100-125°C range up to 150-175°C range

Limit to 120 seconds (known as wetting time)

Reflow Phase:

The temperature rises above the liquidus temperature of 183°C.

Limit time above 183°C liquidus temperature: 60 - 120s

Peak reflow temperature: max. 220°C (± 5°C)

Cooling Phase:

A controlled cooling avoids negative metallurgical effects (solder becomes more brittle) of the solder and possible mechanical tensions in the products. Controlled cooling helps to achieve bright solder fillets with a good shape and low contact angle.

Temperature fall time: max 4°C / s

Caution:

To avoid falling off, the TIM GPS receiver shall be placed on the topside of the motherboard during soldering.

The final soldering temperature chosen at the factory depends on additional external factors like choice of soldering paste, size, thickness and properties of the base board, etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the macro-component.

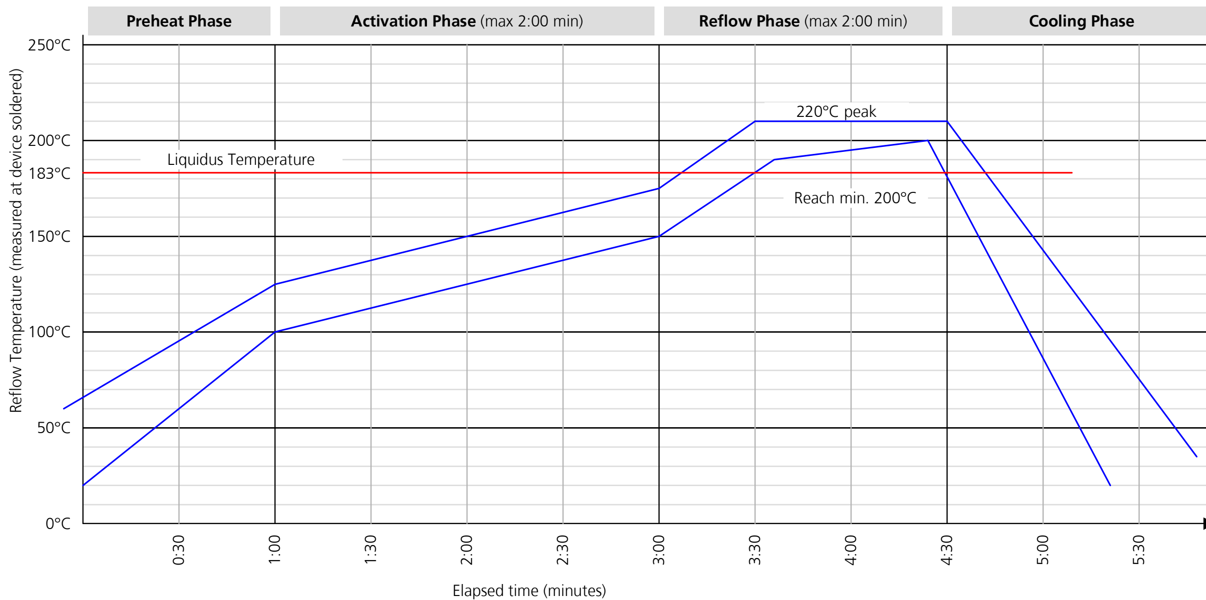


Figure 3-3: Recommended soldering profile

3.6 Optical Inspection

After soldering the TIM macro-components, consider an optical inspection step to check whether:

- TIM macro-component is properly aligned and centered over the pads
- All pads are properly soldered
- No excess solder has created contacts to neighboring pads, or possibly to padstacks and vias nearby.

3.7 Cleaning

In general, cleaning the populated macro-components is strongly discouraged. Residuals, which are underneath the TIM macro-components, cannot be removed easily with a washing process.

- Cleaning with water will lead to capillary effects where water is absorbed in the gap between the base board and the TIM macro-component. The combination of residuals of soldering flux and encapsulated water leads to short circuits or resistor-like interconnections between neighboring pads. Water will also damage the sticker and the ink-jet printed text.
- Cleaning with alcohol or a similar organic solvent will likely flood soldering flux residuals into the two housings which is a place not possible for post-washing inspection. The solvent will also damage the sticker and the ink-jet printed text.
- Ultrasonic cleaning will damage TIM receivers permanently, in particular the quartz oscillators.

The best approach is to consider using a "no clean" soldering paste and eliminate the cleaning step past the soldering.

3.8 Repeated Reflow Soldering

Only a single reflow soldering process is encouraged for boards with a TIM macro-component populated on it. Reason: Risk of falling off due to high weight in relation to the adhesive properties of the solder.

3.9 Wave Soldering

Base boards with combined through-hole technology (THT) components and surface-mount technology (SMT) devices require a wave soldering to solder the THT components. Only a single wave soldering process is encouraged for boards with a TIM macro-component populated on it.

3.10 Hand soldering

Hand-soldering is allowed. Use a Soldering iron temperature setting "7" which is equivalent to 350°C and carry out the hand-soldering according to the IPC recommendations / reference documents IPC7711.

Place the TIM macro-component precisely on the pads. Start with a cross-diagonal fixture soldering (e.g. pins 1 and 16), and then continue from left to right.

3.11 Rework

The TIM macro-component can be unsoldered from the base board. Use dissoldering wick made of copper. Avoid overheating the TIM macro-component.

A vacuum solder sucker is not recommended as solder residuals may remain in the gap below the macro-component.

After all solder has been removed from all pads, lift the component carefully. Continue unsoldering carefully if TIM macro-component does still stick. After the macro-component is removed, clean the pads before placing and hand-soldering a new macro-component.

Attention:

Never attempt a rework on the macro-component itself, e.g. replacing individual components. Such actions will terminate warranty coverage immediately.

3.12 Conformal Coating

Conformal coating with Humiseal or a similar coating product may be necessary in dedicated applications. Please note that the metal covers and the sticker prevent optimum inflow of such liquids or aerosols.

Attention:

Conformal Coating will void the warranty.

3.13 Casting

Use of a viscose or other type of silicon pottant may be used. The OEM is strongly advised to qualify such processes in combination with the TIM macro-component before implementing this in the production.

Attention:

Casting will void the warranty.

3.14 Grounding Metal Covers

Attempts to improve grounding by soldering ground cables, wick or other forms of metal strips directly onto the EMI covers is done on customer's own risk. The numerous ground pins should be sufficient to provide optimum immunity to interferences and noise.

Attention:

u-blox takes no warranty for damages on the TIM macro-component caused by soldering metal cables or any other forms of metal strips directly onto the EMI covers.

Related Documents

[1] JEDEC Specification J-STD-020, J-STD-030, see www.jedec.com

[2] IPC-7530 Guidelines for Temperature Profiling for Mass Soldering (Reflow and Wave) Processses, Mai 2001

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