Module Assembly Recommendations

1- Introduction

1-1 General

This document is intended to provide guidance in utilizing soldering practices to make high quality connections of GAIA Converter modules to printed circuit boards. These assembly recommendations are based upon Gaia Converter's experience which has been built over the years on numerous projects in various fields.
The examples shown in this document are a resume of different assembly processes implemented in the field. Nevertheless they may not be appropriate to every application, that's why we strongly encourage you to validate them in your specific application before adopting any of these solutions for your assemblies

If during assembly operations, devices are stressed beyond the parameters specified in the data sheet, Gaia Converter cannot be held responsible for any degradation or unreliability caused to any of its products.

1-2 Contents

This application note contains the following sections :

2- Referenced Documents

IPC A 610 : Acceptability of Electronic Assemblies. This standard can be found with supporting documentation at www.ipc.org.

J-STD-001 : Requirements for soldered electrical and electronic assemblies. (www.jedec.org)

IPC/JEDEC J-STD-20 moisture sensitivity level.

3- General : Moisture Sensitivity & ESD

GAIA Converter modules are MSL1 classified according to IPC/JEDEC J-STD-20 moisture sensitivity level.

Regarding ESD : observe precautions for handling products.

4- Module Mechanical Fastening

In certain critical applications, mechanical fastenings around the converter to the PCB may be necessary to ensure compliance with shock, bump and vibration specifications.
Certain "heavy" Gaia Converters modules such as the 26W, 30W, 35W, 75W, 100W and 150W series are provided with fitting holes enabling them to be securely screwed to the board.
For the other series, the designer may use other mechanical fastening (clamp, ...) or glue.
In case a mechanical fastening is used the fastening process should be carried out before soldering the pins to the board to avoid having all the stress supported at the solder joint level
In case glue is used it may be preferable to glue after soldering and cleaning.

5- Module Implementation

All Gaia Converter products are provided with terminals dedicated to through-holes mounting.

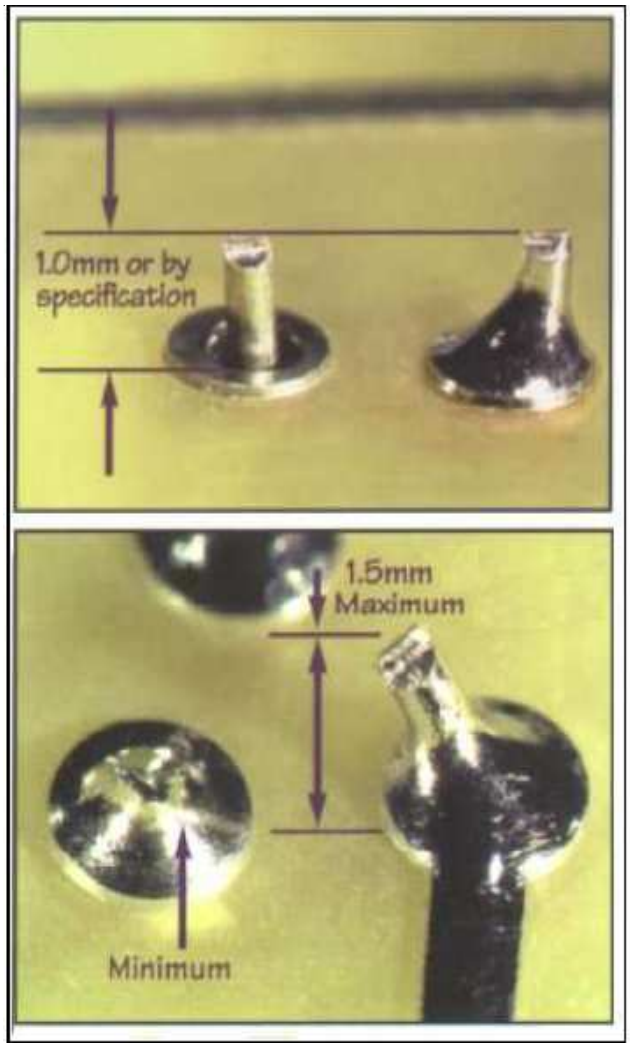
Most GAIA Converter terminals are platted with matte tin over Nickel underplate. They are compliant with iNEMI recommendations and JEDEC/IPC JP002 guidelines for whiskers mitigation (see www.inemi.org and www.jedec.org).
This platting procure also efficient protection against oxidation conserving very good wettability in normal storage conditions (i.e 1 year < 30°C, < 60° RH).

We recommend the implementation of Gaia Converter modules in plated holes with diameter thicker of 0.2~0.3mm (0.008"~0.01") than the pins (in compliance with the international standard : J-STD-001).
In case of square pins, the drilling diameter could be greater by 0.2mm (0.008") than the pins diagonal length.
All converter mechanical pin specifications are clearly stated in the technical data sheets.
(see our web site : www.gaia-converter.com).

Majority of GAIA Converter modules include 0.5 mm height stand-off which allow, fluids to flow under the converters, and also isolation between PCB tracks and module case. For those converters without stand-off, this point has to be adressed by the designer.

6- Pins Trimming

Depending on the mother board thickness it might be necessary to adjust all the pins length equally around 1mm (0.04") length according to IPC-A-610 class 3 (see figure hereafter).
In case of wave soldering use, it is necessary to respect the maximum length of 1.5mm (0.06") to avoid the ball joint accumulation effect. Therefore this operation must be accomplished before the soldering process.



We strictly recommend in this case not to bend the pins during the length adjustment process as this will weaken them and may cause internal damage to the converter. Therefore a special leveling tool may be required for this operation, this could be as simple as a piece of aluminum plate cut to the same level of the pins length and drilled slightly larger than the pins diameter (0.3~0.5mm or 0.012~0.02").

7- Drying

For all encapsulated products, drying is not necessary before assembly.
For non encapsulated products, drying is recommended to remove humidity : a 8 hours @ 100 °C is recommended. Assembly has to be achieved within 24 hours after drying. An exessive drying will affect solderabilty. In all cases do not exceed 125°C.

Majority of GAIA Converter modules are encapsulated and do not need drying.

Humidity in the PCB, on which the module has to be mounted, may also affect reliability. Please follow PCB manufacturer recommendations to dry PCB.

8- Module Soldering Process

We will consider here the 3 usual assembly process :

- reflow
- manual assembly
- wave soldering assembly.

8-1 Soldering Alloys

Different types of soldering alloys may be used.

To comply with RoHS directive (European directive 2002/95/EC) we recommend the use of the tin/silver/copper alloy such as the SAC305. These alloys have to be used only with RoHS iddentified GAIA Converter modules.

For leaded process we recommend the use of the tin/lead or
tin/lead/silver alloy such as the SnPb 63/37, SnPb 60/40 or SnPbAg 62/36/2.

Caution : be carefull not to mix different alloys which may affect soldering reliability.

8-2 Reflow Process

Our products are not designed to support a reflow oven process which may cause serious damage to the converters. We however advise the use of one of the following processes.

8-3 Manual Assembly

Before manual assembly the use of flux may prove to be useful specially in case of lead free process. Keep the use of flux to a minimum to ease cleaning. If you do use flux apply it sparingly to the pins, the pads and plated holes.

The soldering assembly must be undertaken with a solder tip at a temperature below 370°C (measured temperature) for leaded alloys and 410°C for lead free alloys. The solder tip must not be in contact with the pins for more than 10 seconds (ideally 5 seconds).
The soldering iron tip used for this operation must offer a good thermal contact with the pin and pad simultaneously (a 2mm or 0.078" chisel tip would be preferable).

If you are finding bad solder joints we suggest you to consider the following;

- Soldering iron : the power of the iron must be compatible with the thermal inertia of the converter (you can get good results with 80W power iron),
- Tip status : beware of tips oxidation and replace it as often as needed,
- Soldering area status : all surfaces must be clean, greaseless, silicone free..... The PCB must have been designed to support the process, stocked in proper conditions and used within recommended lifetime in order to enssure correct solderability.
- Preheating : the pins must be adequately heated by the soldering iron before adding the solder wire. With converter module, it may take more time than with certain other smaller components.
- Cooling : first remove the solder wire then the iron. Avoid movement of the board and the converters for a while until complete solder solidification.
- Flux : it must be adapted with the alloy (SnPb or SAC).

Carefully adjust the solder quantity : it must be sufficient to fill the plated hole and achieved a good solder filet on both sides of the PCB.

8-4 Wave Soldering Assembly

8-4-1 Board Orientation

The board orientation has to be determinated according to the terminals alignement. Rows of terminals have to go through the waves heads-on.

8-4-2 Flux Application

Application with a flux is necessary in this case to achieve consistent quality of soldered joints.

Spraying or foaming the flux uniformely on to the board.

8-4-3 Preheating

This is a very important phase especially for a converter which has a large thermal inertia and an important thermal coupling between the terminals and the component itself. We therefore have to be sure that the component side pads reach the minimum required of 100°C to 120°C temperature in the preheating phase.

Also make sure that the temperature at the converter top side never exceeds 125°C.

Preheating phase must be long enough to procure a correct behaviour of the flux (refer to the profile specified by the flux manufacturer).

8-4-4 Solder wave

Bath temperature must be between 230°C and 250°C for leade alloys and 265°C maximum for non-leaded alloys. Immersion time must not exceed 10 sec (in case of a double wave soldering also count the time between the first immersion and the second emergence).
If board design allows it (like no SMD on solder side), it is recommended to consider a simple laminar wave solder.

9- Post Solder Cleaning

Gaia Converter is taking a great care to select on it's converter material resistant to chemical aggressions of solvants, saponifiers, alkaline agents, aqueous washing solutions, pressurized spray .... for post-solder cleaning.
However there are so many products on the market place that it is practically impossible to test them all.
The following precautions has to be considered depending on module coating (indicated in GAIA Converter datasheet) :

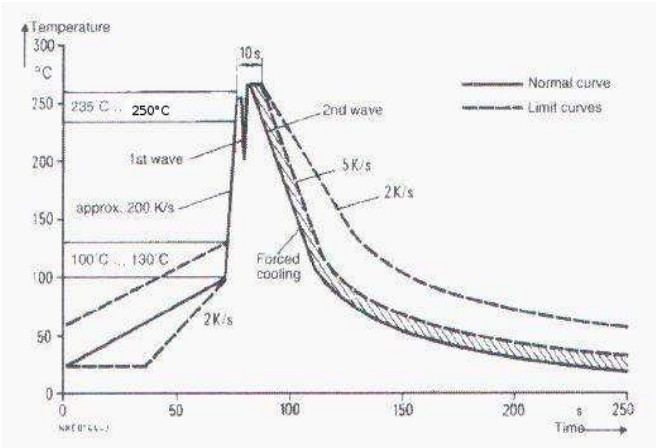
• For alodined coating aluminium case and black anodized coating aluminium case : alkalines cleaning agent may affect irreversibly GAIA Converter module coating.
It is highly recommended in this case to add in the cleaning agent a dedicated additive recommended by the manufacturer.
As example for the «VIGON A200» cleaning product (from ZESTRON company : www.zestron.com) it is highly recommended to add the «CI20» additive.
For the SAFEWASH SWAS cleaning product from ELECTROLUBE/HK WENTWORTH (www.electrolube.com) no additionnal products is necessary as the additive is already included.

• For aluminium black painted modules case :
those GAIA Converter module with such case are very sensitive to cleaning agent that may affect irreversibly module coating. In this case we recommend a local cleaning without immersion.

Appearance modification may be observed (tarnished appearance, marking damage, ..) after cleaning without affecting the module functionnality.

In case cleaning is needed, please make sure that the chosen cleaning aid is compatible with the converter characteristics. In case of incompatibility, we recommend a local cleaning.

For further information please consult GAIA Converter.



10- Inspection

Gaia Converter use IPC-A-610 standard as a control reference. We recommend the class 2 or 3 level in relation to the final supplied equipment.
The IPC-A-610 standard requires that the solder fill at least 75% of the barrel in order to ensure a reliable joint. Ideally all joints should have a 100% fill. The solder should form a concave meniscus between pins and barrel. The joint between solder and pin as well as solder and pad should always exhibit a feathered edge. The solder joint should have a smooth shiny silver color and the area around should be clean and free from resin or solder residu. Also the pad and PCB adjacent to the barrel should not exhibit a burn or discolored spot.

It may happen than some solder joint on the module side cannot be easily inspected. That's why we suggest you to validate the assembly process during industrialization in order to ensure reliable and repeatable solder joint.

11- Rework and Repair

11-1 Rework

We advise that during a rework on a solder joint to remove the existing solder and properly clean the pad around and the converter pin before resoldering that pin again on the board. This resoldering should be handled according to the recommendation described in paragraph **«Module Manual Assembly»** (respect time and temperature indicated to remove the existing solder as well as to resolder)

It is advised not to perform more than 2 reworks on the same pin.

11-2 Removal

We do not recommend the re-use of dismounted converter. Most desoldering procedures introduce damaging mechanical and thermal stresses to the module.
Gaia Converter cannot guarantee the reliability in this case.

12- Common Soldering Defects

12-1 Cold Solder Joint

A cold solder joint is an incomplete or poor connection caused by either the barrel or the pin not being heated to the flow temperature of solder. A cold solder joint will typically exhibit a convex meniscus with a possible dark point around the barrel or pad. Also a cold solder join will not have a bright silver surface but will exhibit a dirty appearance. A cold solder joint will frequently conduct to electrical inttermittence.

Recommended solution : increase soldering iron temperature, soldering time or use a soldering iron with higher power. If process is wave soldering, lower the conveyor speed or increase preheating temperature.

12-2 Dry Joint Solder

A dry joint solder has a dully gray apperance as opposed to a bright silver surface. The solder joint may have a mottled look as well. It is caused by the solder joint moving before complete cooled.

Recommended solution : immobilize the module with respect to the PCB to ensure that the solder joint cools properly.

12-3 Solder Holes

Small or large solder holes in the surface of solder joint, most commonly occuring in wave soldering processes.

Recommended solution : increase preheating or heat temperature.

12-4 PCB Board Dammage

It is an intermittent or poor connection caused by damage to a trace, a pad or a barrel. A damaged pad is best identified by a burned mark on the PCB, or a trace of pad that moves when prodded with a mechanical tip.

Recommended solution : lower the soldering iron temperature or the soldering time.

12-5 Icicles

Jagged or conicle extensions from solder fillet. These are caused by soldering with a too low temperature or soldering to a highly heat absorbant surface.

Recommended solution : increase the soldering temperature. If necessary use a higher power soldering iron.

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