

ATL PCBA Standards for Suppliers

Purpose:

This document outlines Alpha Technologies Ltd. (“ATL”) standard requirements related to the assembly of Printed Circuit Board Assemblies (PCBAs), including those PCBAs with additional metalwork installed.

Scope:

This document applies to all suppliers who supply to ATL manufactured, fabricated or processed parts as part of meeting the contractual requirements of an ATL-issued and supplier-accepted Purchase Order. Specific requirements within this document apply as appropriate to the parts or services being supplied to ATL.

Definitions:

AOI: Automated Optical Inspection. A manufacturing test system that uses optical vision to identify defects during the manufacturing of a PCBA, primarily orientation of components and components not installed (missing).

ATE: Acceptance Test Equipment. Equipment designed specifically to test product as per an ATP.

ATL: Alpha Technologies Limited.

ATP: Acceptance Test Procedure. A functional test procedure that is specified by ATL. Execution of an ATP may or may not be automated.

Burn-in: Burn-in is the process by which components of a system are exercised prior to being placed in service (and often, prior to the system being completely assembled from those components), with the goal of detecting those particular components that would fail as a result of the initial, high-failure rate portion of the bathtub curve of component reliability. Burn-in is frequently conducted at elevated temperature and perhaps elevated voltage.

DPMO: Defects per Million Opportunities. DPMO is defined as the total number of defects divided by the total number of opportunities for a defect multiplied by one million. The number of opportunities for defects is based on the component, termination, and placement count, refer to IPC-7912.

ESD: Electrostatic discharge (ESD) is the sudden flow of electricity between two objects caused by contact, an electrical short, or dielectric breakdown. ESD can be caused by a buildup of static electricity by tribocharging, or by electrostatic induction, and can cause damage to electronic components and assemblies.

First Article Production: First Articles of a new or modified part or subassembly of medium to high complexity or criticality. Typically 1-10 units produced in a lot, but may be as high as 30-50 units.

FPTY: First Pass Test Yield. The lot percentage of PCBAs that pass visual inspection, AOI, ICT and/or functional test with zero defects.

ICT: In-Circuit Test. An electrical probe tests a PCBA, checking for shorts, opens, resistance, capacitance, and other basic measurements which will show whether the assembly was correctly fabricated.

PCB: Printed circuit board. A printed circuit board is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate.

PCBA: Printed circuit board assembly. A PCB populated with electronic components.

Pilot Build Production: First Production-level build of a new or modified part or subassembly of medium to high complexity or criticality. Typically 20-100 units produced in a lot, but may be as high as 500 units.

Prototype Production: Sample(s) of a new part or subassembly of low complexity or criticality. Often used for design verification, fit-check, look and feel, quality of finish. Typically 1-10 units produced in a lot.

Reference Designator: A unique identifier associated with a component in an electrical schematic (circuit diagram) or on a PCBA. The reference designator usually consists of one or two letters followed by a number, e.g. R13, C1002.

RoHS: Restriction of Hazardous Substances Directive – an European Union directive (2011/65/EU) that restricts the use of six hazardous materials in the manufacture of various electronic and electrical products.

Standard Production: Repeated Production-level build of a part or subassembly of medium to high complexity or criticality. Typically 100-200 units produced, but may be as high as 5000 units.

Supplier: An organization that supplies finished goods, raw materials and/or services to ATL.

References

The following documents in their current revision or successor shall form a part of this specification to the extent applicable:

- ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
- IPC-A-600 (latest revision) Class 2 Acceptability of Printed Boards
- IPC-A-610 (latest revision) Class 2 Acceptability of Electronic Assemblies Standard
- IPC-7711 (latest revision) Class 2 Rework of Electronic Assemblies
- IPC-7721 (latest revision) Class 2 Repair and Modification of Printed Boards and Electronic Assemblies
- IPC-9502 (latest revision) Class 2 PWB Assembly Soldering Process Guideline for Electronic Components
- IPC-9503 (latest revision) Class 2 Moisture Sensitivity Classification for Non-IC Components

- IPC J-STD-001 (latest revision) Class 2 Requirements for Soldered Electrical And Electronic Assemblies
- IPC J-STD-002 (latest revision) Class 2 Solderability Requirements for Electronic Components
- IPC J-STD-003 (latest revision) Class 2 Solderability Tests for Printed Boards
- IPC J-STD-004 (latest revision) Class 2 Requirements for Soldering Fluxes
- IPC J-STD-005 (latest revision) Class 2 Requirements for Soldering Pastes
- IPC J-STD-020 (latest revision) Class 2 Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices
- IPC J-STD-033 (latest revision) Class 2 Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices
- GR-78-CORE: Surface Insulation Resistance of bare PCBs: 1×10^4 megohms minimum average. (Ref. GR-78 Issue 1, Section 13.2.6, 14.4.4: Clause R14-4)
- GR-78-CORE: Voltage Breakdown: PCB must withstand minimum 600Vac, 50-60Hz or 1000Vdc for 1 minute. Higher voltages may be required when applicable. (Ref. GR-78-CORE Issue 1, Section 6.2.2.8, Clause R6-199)
- GR-78-CORE: Solvent Extract Conductivity: 1 ug/cm^2 max. (Ref GR-78-CORE Issue 1, Section 6.2.2.6, Clause R6-193)
- GR-1221-CORE: Glass Transition Temperature Tg for Label Adhesives (Tg must be $\geq 95^\circ\text{C}$. Ref. GR-1221-CORE Issue 2, Clause R4-24)
- IPC-TM-650 (latest revision) Class 2 Test Methods
- IPC-A-610DC (latest revision) Class 2 Telecom Addendum
- IPC J-STD-003 Solderability Tests for Printed Boards
- GR78 - 6.11.4 [R6-7] Repair Polymers
- GR78 – 6.1.1.14 [R6-122] Repairs

1.0 General Requirements

Suppliers shall meet the requirements outlined as follows:

1.1 Component Procurement and Handling

Components purchased for Alpha products must be in compliance with the Qualified Parts List (QPL) provided by ATL. No substitution is permitted without a written Temporary Deviation Notice (TDN).

Components must be handled to minimize damage due to ESD, poor packaging, moisture sensitivity and similar as per the requirements listed above.

Bare PCBs must be stored in temperature and humidity controlled conditions. For shipment, bare PCBs must be packed in a MBB (moisture barrier bag) with desiccant and HIC (humidity indicator cards).

1.2 Solder and Solderability Requirements

All solder used must be SAC 305. For wave soldering, SAC300 may be used as an addition to SAC305 to manage the copper level of the solder bath; however, the mixed alloy composition in the wave solder bath must meet SAC305 specification.

All PCBs must meet IPC J-STD-003 (latest revision) Class 2 as follows: Test methods A1 and C1 for lead-free solderability, to 255°C ± 5°C; 5 secs. max.

1.3 Prototypes /First Article Inspection (FAI)

First Article Inspections must be performed for:

1) New bare PCB Supplier and/or 2) All new production part numbers and/or 3) when the supplier moves a manufacturing site. FAIs must be performed by the bare PCB supplier and verified by the Contract Manufacturer. Additional requirements may be requested by Alpha. Alpha may also perform verification FAI as well. For the Bare PCB First Article sample, the supplier shall provide the following-information per “Alpha’s or Contract Manufacturer’s PCB First Article Inspection (FAI) requirements” with the sample. For Prototype or First Article PCBAs, ensure one (1) unassembled PCB panel is to be provided to Alpha, clearly labeled “*SAMPLE – not for resale*”.

Required Elements of a First Article Report for (bare) PCBs

- UL file number (if applicable)
- Certification of conformance for the PCB stating compliance to RoHS (2011/65/EU)
- Dimensional measurement
- Visual inspection (per IPC-A-600 (latest revision) Class 2)
- X-ray inspection for multi layer bare PCBs
- Thermal stress analysis, T260 (if feasible or as requested)
- Bare PCB Solderability test (if feasible or as requested)
- Others (per Alpha’s request)

Required Elements of a First Article Report for PCBAs

- UL file number (if applicable)
- Certification of conformance for the PCBA stating compliance to RoHS (2011/65/EU) (PCB, all assembled components and all materials used in processing)
- Dimensional measurement
- Visual inspection (per IPC-A-610 (latest revision), Class 2 unless otherwise specified)
- X-ray inspection (if applicable)
- AOI inspection results
- Mechanical Fit test (if applicable)
- Functional test (if applicable)
- Others (per Alpha’s request)

1.4 Yield and Defect Rates

Refer to ATL document [REF-QA-04 Production Stages and Responsibilities](#) for a detailed description of acceptable yield and defect rates for different types of PCBA assembly jobs.

1.5 Inspection

- a) Visual Inspection Standard for **PCBAs** shall be **IPC-A-610**-(latest revision) **Class 2** unless otherwise specified on ATL drawings. This means 100% of all assemblies must undergo visual inspection. AOI may be used to reduce this requirement only with prior approval from ATL. X-ray inspection has unique capability in isolating hidden defects such as solder ball inconsistencies in BGAs and other array-style packages and heels of solder joints on fine pitch packages. X-ray is not considered visual inspection, although it may be used for process validation.
- b) Visual Inspection Standard for **PCB** shall be **IPC-A-600** (latest revision) **Class 2** unless otherwise specified on ATL drawings. This means 100% of all bare PCB must undergo visual inspection or AOI including inner layers if applicable. This should be performed by the PCB manufacturer.

1.6 Testing

- a) PCBAs are often tested as part of a finished subassembly, that is one or more PCBAs assembled with metal work and other components to create a finished assembly. ATL assemblies are to be tested in accordance with the ATL provided ATP, and may use an ATE system to do this in an automated manner.

ATPs and ATEs are strictly controlled by ATL and cannot be changed without an Engineering Change Order (ECO) or a Temporary Deviation Notice (TDN) provided by ATL.

- b) All bare PCB must undergo 100% Electrical Test unless waived by Alpha. Any waivers must be documented using ATL's waiver template.

1.7 Rework

No rework is allowed, except for the following:

- A PTH & Surface Mount component site may be reworked/touched-up no more than **TWO** times using methods stated in IPC-7711/7721 or ATL's approved method or ATL's deviation request. The reworked site must pass the visual inspection requirements as stated in this specification.
- Rework of any single DRAM is limited to **ONE** time only.
- Lead straightening (both "combing" and "reforming") of component leads is permitted as long as the lead finish is not damaged.
- Units failing visual inspection or functional test after rework must be scrapped.
- All rework must comply with RoHS requirements.
- All other rework operations are not allowed without ATL approval.
- All rework must be recorded.

1.8 RoHS Compliance

Compliance to RoHS is required as per 0700008: ATL RoHS/REACH Standard for Suppliers. Please refer to that document for more information.

1.9 Markings

Manufacturer shall add to the component identification layer their name and/or logo, board material type, UL file number, UL temperature rating, UL CTI rating. For PCBAs, a “Made in [country]” label should also be applied.

Applied labels shall NOT cover any exposed traces, as many labels have been known to be corrosive over time.

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