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Printed Circuit Boards

1 Introduction

1.1 Purpose

The following are requirements specific to the topic of Printed Circuit Boards (PCBs) that are in addition to the requirements set forth in the Supplier Quality Manual (SQM) and individual Lake Shore Engineering Drawings. If a conflict or discrepancy is noted between these documents, please contact the Buyer listed on the Purchase Order (PO) for clarification. Traceability or record retention terms imposed upon Lake Shore by our Customer are flowed down to the Supplier. If traceability is required, the requirements will be included on the PO.

1.2 Definitions

Abbreviations and acronyms used in this document are defined as follows:

- ECO.....Engineering Change Order
- ESDElectrostatic Discharge
- NDANon-Disclosure Agreement
- PCBPrinted Circuit Board
- PO.....Purchase Order
- ROSE.....Resistivity of Solvent Extract
- RoHS.....Restriction of Hazardous Substances
- Supply ChainDepartment formerly known as Purchasing
- SQMSupplier Quality Manual

1.3 Associated Documents and Forms

Lake Shore has established an internet webpage to provide Suppliers quick access to required documents, including an electronic copy of the documents shown below:

- CP-0080-2..... Confidentiality Agreement Form (also known as Non-Disclosure Agreement, or NDA)
- QP-Supplier Terms and Conditions
- QP-Supplier Quality Manual

Symbols used in Lake Shore drawings are defined in the Drawing Requirements Manual (DRM) and associated ASME Y14 Family of specifications.

NOTE: Lake Shore uses and imposes IPC and other standards as applicable. Lake Shore does not provide these standards. They are copyright protected and the responsibility of the supplier to obtain, when required.

1.4 Supplier Quality Management System Requirements

The requirements set forth in §2.1 of the SQM are amended for PCB Suppliers. Lake Shore requires PCB Suppliers to be ISO 9001 certified. The Supplier must provide a copy of their ISO 9001 Certificate. Also, remember to send updates after any re-certification or other change in status.

2 Acceptability and Workmanship

Acceptability of bare PCBs is governed by IPC-A-600 – Acceptability of Printed Boards. Acceptability of the completed circuit board with components installed is governed by IPC-A-610 – Acceptability of Electronic Assemblies. If there are associated cable assemblies, acceptability is governed by IPC/WHMA-A-620 – Requirements and Acceptance for Cable and Wire Harness Assemblies. All criteria shall meet IPC Class 2 requirements, or better.

The PCB Supplier is assumed to be an expert in all aspects of circuit board production and shall not use this document as a basis for providing product that is below normal standards of production in any manner. Lake Shore is dependent upon the PCB Supplier to deliver circuit boards in accordance with the committed date, at the committed price, and subject to conditions specified in this document. Failure to do so may cause irreparable harm to Lake Shore.

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3 PCB Drawings and Electronic Files

Lake Shore uses PCB designer software to generate files used for PCB fabrication and assembly.

For PCB Fabrication:

- Gerber data for needed layers are provided in RS274X format.
- Other output formats (ODB++, IPC-2581, etc.) are available upon request.
- The Numeric Control (NC) Drill Files for plated and non-plated holes is also provided.

For PCB Assembly:

- Gerber files – Only paste layers for creating solder paste stencils.
- ASCII file of the PCB – File should only be used for reference.
- Pick and place files – Used for placing surface mount parts by machine.
- Smart PDF file – Reference file showing PCB in PDF format.

Supply Chain provides a Bill of Materials (BOM) from Altium Designer. Schematic PDFs are available upon request to production board assembly houses that have an established NDA.

4 PCB Materials

PCB material is specified in the Gerber data notes. Generally, Lake Shore specifies RoHS compliant IPC 4101/126 (Woven E-Glass, Flame Resistant, Glass Transition Temperature (Tg) 170 °C minimum., corresponds to UL/ANSI FR-4/126). Material must conform to UL 94 – Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances, Class V-0 = burning stops within 10 seconds on a vertical specimen. A Conductive Anodic Filament (CAF) resistant laminate is specified when the PCB has 8 or more layers.

5 Cleaning

The acceptability for PCB cleanliness is outlined in IPC-A-610 – Acceptability of Electronic Assemblies. Removal of aqueous-based flux must be verified as less than 10 µg/in² (1.56 µg/cm²) sodium chloride (NaCl) equivalent ionic or ionizable flux residue, or in some cases, twice the standard level 5 µg/in² (1.56 µg/cm²), using the Resistivity of Solvent Extract (ROSE) tests defined in IPC TM-650 – Test Methods Manual.

6 Assembly Procedures

An assembly procedure is written for each PCB by Lake Shore. The procedures are written in Microsoft Word and a copy is provided as an Acrobat PDF with each PCB order. The procedures are under Lake Shore ECO control. Changes to active POs are determined by ECO disposition, which is case by case. Choices include finish as is, rework, or scrap. Supply Chain will ensure the Supplier is notified of any ECOs and will coordinate revisions to the assembly procedure. In the event a temporary deviation is required, Lake Shore will use the Supplier's temporary deviation system, filling out and approving whatever information is necessary to implement the temporary deviation.

7 Test Fixtures

If a test fixture is required, it is built and controlled by the Supplier. If the fixture is created using a Lake Shore instrument, then Lake Shore will supply dummy test loads and basic written instructions on what to test. The included PCB from this instrument, will act as a "golden board" for reference, to ensure the test fixture is functioning properly.

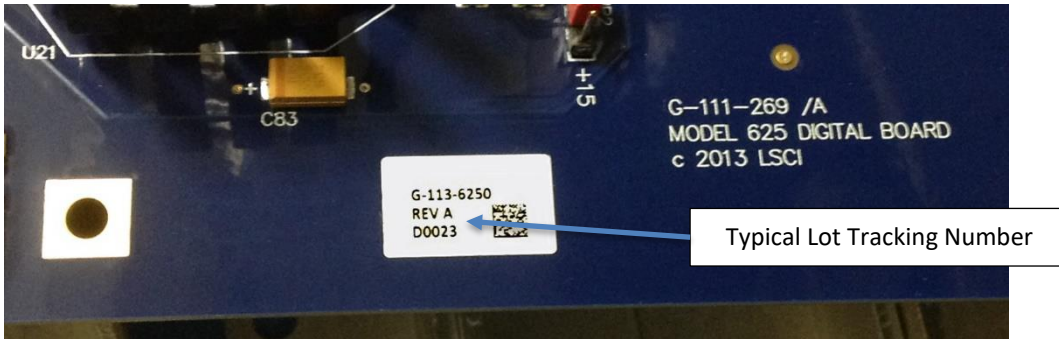
When using a test fixture, Lake Shore requests that some form of identification be physically affixed to each PCB, either by stamp or sticker, to signify the PCB has passed the test. Test records must be kept by the Supplier and be made available upon demand in the event of any issues with a lot or board.

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8 Traceability, Lot Codes, and Marking Requirements

A unique lot code must be assigned to each batch of circuit boards produced for Lake Shore. Each Supplier is free to choose the format for the lot code, however, we recommend revision and some unique code number, as show in the figure below. We also request the lot code appear on the packing list.

Individual PCB markings for lead free and terminal finished/materials are in accordance with JEDEC J-STD-609 – Marking, Symbols, and Labels of Leaded and Lead-Free Terminal Finished Materials Used in Electronic Assembly.



Typical Lot Tracking Label

9 Repair and Rework

The Board House has access to both schematics and test fixtures to troubleshoot and isolate PCB failures. The result of any PCB repair or rework must meet the requirements of IPC-7711/7721 – Rework, Modification and Repair of Electronic Assemblies. Repair or rework not permitted under IPC-7711/7721 requires written authorization from Lake Shore. If Lake Shore issues an ECO that requires a PCB modification or rework, it will be accompanied by written instructions.

10 Packaging and Transport

Each shipment must be packed in a manner to minimize any risk of damage and in accordance with IPC-1601 – Printed Board Handling and Storage Guidelines. It is ultimately the Supplier’s responsibility to ensure the PCBs at the Lake Shore facility free of damage and protected from ESD and contamination.

11 Obsolescent/Obsolete Part Substitution

Part substitution is defined in Section 2.3 of the SQM. Substitutions for electronic parts that are either obsolescent or obsolete must be approved by Lake Shore Product Development. Approval of Supplier-suggested substitutions is not automatic and is approved by Lake Shore on a case-by-case basis. The Supplier must also conform to the counterfeit part policy specified in Section 2.5 of the SQM.

12 Inspection and Test Records

Inspection of PCBs are in accordance with IPC-6012 – Qualification and Performance Specification for Rigid Printed Boards. The Supplier must keep test results for a minimum of 5 years, including test or QC results from their bare PCB supplier. If Lake Shore receives an order with a record retention longer than 5 years, the requirement will be flowed down to the Supplier via the PO.

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13 PCB Documentation

PCB documentation requirements are as follows:

1. For New Suppliers:
 - a. ISO Certification.
 - b. IPC-A-610 Certification Compliance.
 - c. Ionic Test Results.
2. Each New Product:
 - a. RoHS Certification.
 - b. Conflict Mineral Certification.
 - c. First Article Report.
3. Each Shipment:
 - a. Packing Slip with references to PO and Lot information.
 - b. Certificate of Compliance.
4. Upon request:
 - a. Solder Sample for each new date code.
 - b. Solderability Test Results.
 - c. Certificates of Origin.
 - d. Microsections and Microsection Reports.