IPC-1782A

Standard for Manufacturing and Supply Chain Traceability of Electronic Products

Developed by the Critical Components Traceability Task Group (2-19a) of the Electronic Product Data Description Committee (2-10) of IPC

Supersedes:
IPC-1782 - October 2016

Users of this publication are encouraged to participate in the development of future revisions.

Contact:

IPC

Table of Contents

1 SCOPE 1
1.1 Purpose 1
1.1.1 About This Standard and the Concept of Traceability 1
1.1.2 Internal and External Traceability 2
1.1.3 Application of This Standard 2
1.1.4 Sectional Traceability Standards and the Maintenance of This Standard 2
1.2 Classification 2
1.3 Definition of Requirements 3
1.4 Order of Precedence 3
1.4.1 Conflict 3
1.4.2 Clause References 3
1.4.3 Appendices 3
1.5 Abbreviations and Acronyms 3
1.6 Terms and Definitions 3
1.6.1 As Agreed Between User and Supplier (AABUS) 3
1.6.2 Authorized Supplier 3
1.6.3 Automated Data Collection / Data-Gathering Automation 4
1.6.4 Batch Code 4
1.6.5 Cell 4
1.6.6 Cell Structure 4
1.6.7 Common Materials 4
1.6.8 Component 4
1.6.9 Dashboard 4
1.6.10 Data Integrity 4
1.6.11 Date Code 4
1.6.12 Lot Number 4
1.6.13 Manual Data Management 4
1.6.14 Material Traceability 4
1.6.15 Materials 4
1.6.16 Mechanical Assembly 4
1.6.17 Process Identification (ID) 4
1.6.18 Process Traceability 4
1.6.19 Product Build Records 4
1.6.20 Production Lot 4
1.6.21 Raw Materials 4
1.6.22 Risk 4
1.6.23 Risk Analysis 4
1.6.24 Risk Assessment 4
1.6.25 Risk Management 5
1.6.26 Serial Number 5
1.6.27 Serialization 5
1.6.28 Subassembly 5
1.6.29 Traceability 5
1.6.30 Unique Assembly ID 5
1.6.31 Unique Materials 5
1.6.32 Work-Order 5

2 APPLICABLE DOCUMENTS 5
2.1 IPC 5
2.2 Joint Industry Standards 5
2.3 Electrostatic Discharge Association (ESD) 5
2.4 International Organization for Standardization (ISO) 5
2.5 JEDEC 5

3 GENERAL REQUIREMENTS 6
3.1 Guidance on the Use of This Standard 6
3.1.1 Conduct Risk Assessment 6
3.1.2 Determine Traceability Level 6
3.1.3 Document Action in User Agreement 6
3.1.4 Monitor Risk / Update Traceability Level 6
3.2 Nonconforming Items 6
3.3 Scope and Application of Traceability Recording 7
3.4 Requirement for Computerized Systems 7
3.4.1 Internal Traceability Computerized System 7
3.4.2 External Traceability Computerized System 7

4 LEVELS OF TRACEABILITY 8
4.1 Levels of Internal Traceability 8
4.1.1 Material and Process Traceability Levels 8
4.2 Levels of External Traceability 9
4.2.1 Material and Process Traceability Levels 10
4.3 Guideline for Anti-counterfeit Use 10
4.4 Guidelines for Classification and Internal Traceability Levels 10
4.5 Guidelines for Classification and External Traceability Levels 11

5 CELL STRUCTURE AND CONTENTS 12
5.1 Assembly Cell 13
5.2 Work-Order Information Cell 15
5.3 Bill of Materials Cell 15
5.4 Material Traceability Cell 15
5.4.1 Unique Material/Subassembly Traceability Cell 16

5.4.2 Software/Firmware Material Traceability Cell 16
5.4.3 Packing and Shipping Material Traceability Cell 17
5.4.4 Label Material Traceability Cell 17
5.4.5 Hazardous Substance Cell 17
5.4.6 Material Test Cell 17
5.5 Process Traceability Data Cell 18
5.5.1 Common Process Traceability Data Cell 18
5.5.2 Unique Process Traceability Data Cell 18
5.6 Process Maintenance Cell 27

6 EXTERNAL TRACEABILITY (SECURE SUPPLY CHAIN) 27
6.1 Supply Chain Event 27
6.1.1 Event Types 28
6.1.2 Packages 28
6.1.3 Unique ID 28
6.1.4 Material Information 29
6.1.5 Process Information 29
6.1.6 Asset Owner 29
6.1.7 Process Owner 30
6.1.8 Event Location 30
6.1.9 Event Processing Tasks 30
6.2 Secure Supply Chain Database 31
6.2.1 Database Structure 32
6.2.2 Access to External Traceability Data 32

APPENDIX A Acronym Index 34

Figures

Figure 1-1 Typical Supply-Chain 2
Figure 5-1 Traceability Cell Structure 12
Figure 6-1 The Secure Supply-Chain Event Elements 27
Figure 6-2 Architecture of External Traceability Data In The Secure Supply-Chain Database 32

Tables

Table 3-1 Typical Risk Assessment Matrix 6
Table 4-1 Internal Traceability Levels 8
Table 4-2 External Traceability Levels 10
Table 4-3 Traceability Levels to IPC Product Classification System Matrix 10
Table 4-4 Traceability Level Recommendations for IPC Product Class 1 10
Table 4-5 Traceability Level Recommendations for IPC Product Class 2 11
Table 4-6 Traceability Level Recommendations for IPC Product Class 3 11
Table 4-7 Traceability Level Recommendations for IPC Product Class 3 (Space/Defense/Medical) 11
Table 4-8 Traceability Levels to IPC Product Classification System Matrix 11
Table 4-9 Internal vs. External Traceability Levels 11
Table 5-1 Abbreviated Process Traceability Level Matrix 13
Table 5-2 Assembly Cell Material Traceability 14
Table 5-3 Assembly Cell Process Traceability 14
Table 5-4 Work-Order Information Cell Process Traceability 15
Table 5-5 Bill of Materials Cell Traceability 15
Table 5-6 Materials Traceability Cell 16
Table 5-7 Unique Material/Subassembly Traceability Cell 16
Table 5-8 Software/Firmware Material Traceability Cell 16
Table 5-9 Packaging and Shipping Material Traceability Cell 17
Table 5-10 Label Material Traceability Cell 17
Table 5-11 Common Process Traceability Cell 18
Table 5-12 Common Process Traceability Cell 18
Table 5-13 Product Routing Station, Printed Board Flip/Turn, Storage/Stock/Waiting Area Traceability Cell 19
Table 5-14 Screen Printer Traceability Cell 19
Table 5-15 Automated Paste Inspection Traceability Cell 19
Table 5-16 Glue Dispenser Traceability Cell 19
Table 5-17 SMT Placement Traceability Cell 20
Table 5-18 Pin Through-Hole Insertion (Automated and Manual) Traceability Cell 20
Table 5-19 Manual Printed Board Assembly Traceability Cell 20
Table 5-20 Reflow Traceability Cell 21
Table 5-21 Wave Solder/Selective Solder/Wash Traceability Cell 21
Table 5-22 Manual Visual Inspection Traceability Cell 21
Table 5-23 Automated Optical Inspection (AOI) and X-Ray Inspection Traceability Cell 21
Table 5-24 In-Circuit Test (ICT) Traceability Cell 22
Table 5-25 Press-Fit Operations Traceability Cell 22
Table 5-26 Touch-Up Operations Traceability Cell 22
Table 5-27 Encapsulation Traceability Cell 22
Table 5-28 System/Sub/Final Assembly (Mechanical Assembly by Robot or Manually) Traceability Cell 23
Table 5-29 Software/Firmware Programming Traceability Cell 23
Table 5-30 Quality Assurance Check/Test/Inspection Traceability Cell 23
Table 5-31 Repair/Rework Station Traceability Cell 23
Table 5-32 Functional Test (FT) Traceability Cell 24
Table 5-33 Burn-In/Extended Test Traceability Cell 24
Table 5-34 Shipping/End-User/Post-Manufacturing Environment Test Traceability Cell 24

Table 5-35 Packing and Shipping Traceability Cell 24
Table 5-36 Process Deviations Traceability Cell 25
Table 5-37 Labeling Traceability Cell 25
Table 5-38 Printed Board Etching Process Traceability Cell 25
Table 5-39 Printed Board Oxide Process Traceability Cell 25
Table 5-40 Printed Board Plating Process Traceability Cell 25
Table 5-41 Printed Board Developer Process Traceability Cell 26
Table 5-42 Other Printed Board Wet Process Traceability Cell 26
Table 5-43 Exceptions Traceability Cell 26
Table 5-44 Process Maintenance Traceability Cell 27
Table 6-1 Packages External Traceability Cell 28
Table 6-2 Packages Unique ID External Traceability Cell 28
Table 6-3 Material Information External Traceability Cell 29
Table 6-4 Process Information External Traceability Cell 29
Table 6-5 Process Owner External Traceability Cell 30
Table 6-6 Event Location External Traceability Cell 30
Table 6-7 Data Creator Access Rights 33
Table 6-8 Data Consumer Access Rights 33

Standard for Manufacturing and Supply Chain Traceability of Electronic Products

1 SCOPE

This standard establishes minimum requirements for manufacturing and supply chain traceability based on perceived risk. This standard applies to all products, processes, assemblies, parts, components, equipment used and other items as defined by users and suppliers in the manufacture of printed board assemblies, as well as mechanical assembly and printed board fabrication. This standard is applicable both for internal traceability (i.e., traceability within the environment in which the product is assembled) and external traceability (i.e., as products and materials are moved between locations as part of their supply chain).

Minimum requirements are based on four levels of traceability for materials and processes. These levels can correlate to the IPC Product Classification System (Class 1, Class 2, Class 3 and Space/Defense/Medical) and/or another set of categories of compliance, based on the business model/economic needs of the end-use market for the final product (e.g., telecom, aerospace, automotive, medical device, consumer electronics) or a subassembly within that product.

1.1 Purpose Historically, the lack of a uniform component traceability standard has caused an unnecessary consumption of resources (e.g., time, people, money) to track events or parts to their sources and to remedy any quality, reliability, etc., issues. Lack of a standard has also made it difficult to uniformly create and appropriately enforce the necessary contracts.

The traceability information detailed in this standard is intended to improve operational efficiency and productivity, quality and reliability as well as to enable activities such as predictive maintenance in the manufacturing environment. This standard can help organizations more easily ensure end users / consumers will receive products and services that meet or exceed their expectations in the timeliest and most economically viable method.

This standard can also aid in reducing counterfeit components in an organization's supply chain, whether using an authorized supplier or not.

1.1.1 About This Standard and the Concept of Traceability Traceability has grown from being a specialized need for safety-critical segments of industry to a recognized tool that adds value to industry as a whole. Disparate standards that have evolved, mainly dictated by large original equipment manufacturers (OEMs), can create confusion in the market, as a multitude of requirements and definitions proliferate. The intent of this standard is to bring the whole principle of traceability up to date. Traceability, as further described in this standard, represents both the most effective quality tool available internally within assembly operations, which can become an intrinsic part of best-practice operations, as well as the traceability of packages between locations of material manufacture and product assembly, ensuring contents of transported items are not compromised (i.e., by ingress of counterfeit materials). This is accomplished with the encouragement of automated data collection from systems already integrating quality, manufacturing, engineering and supply chain, thus reducing cost of ownership and ensuring timeliness and accuracy.

The wealth of analysis data accessible from traceability can yield information that can raise expectations for very significant quality and performance improvements, as well as provide the necessary protection against the costs in the market as a result of adverse issues.

This standard creates a flexible data architecture that can be adopted to represent all levels of traceability that are required across industry. This includes support for the most demanding instances for detail and integrity (e.g., critical-safety systems) through to situations in which only basic traceability may be needed (e.g., simple consumer products). This standard presents a cellular-based structure to provide required flexibility and create an efficient format in which unnecessary duplication of data is avoided. The format also allows data to be added after the completion of production, enabling further detail to be added as it becomes available.

Throughout the design of this standard, different key usage models of traceability were considered. It is written to explain how access to critical data, when needed to identify the exact scope of any market issues, can be ensured, while also being capable of providing ''live'' access to detailed product-build records for advanced quality analysis.

This standard also demonstrates the benefits of best-practice data collection through automated means. This is reflected in the definitions of the different levels of traceability.