



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

<b>1 SCOPE</b> .....	1	1.6.27 Serialization .....	5
1.1 Purpose .....	1	1.6.28 Subassembly .....	5
1.1.1 About This Standard and the Concept of Traceability .....	1	1.6.29 Traceability .....	5
1.1.2 Internal and External Traceability .....	2	1.6.30 Unique Assembly ID .....	5
1.1.3 Application of This Standard .....	2	1.6.31 Unique Materials .....	5
1.1.4 Sectional Traceability Standards and the Maintenance of This Standard .....	2	1.6.32 Work-Order .....	5
1.2 Classification .....	2	<b>2 APPLICABLE DOCUMENTS</b> .....	5
1.3 Definition of Requirements .....	3	2.1 IPC .....	5
1.4 Order of Precedence .....	3	2.2 Joint Industry Standards .....	5
1.4.1 Conflict .....	3	2.3 Electrostatic Discharge Association (ESD) .....	5
1.4.2 Clause References .....	3	2.4 International Organization for Standardization (ISO) .....	5
1.4.3 Appendices .....	3	2.5 JEDEC .....	5
1.5 Abbreviations and Acronyms .....	3	<b>3 GENERAL REQUIREMENTS</b> .....	6
1.6 Terms and Definitions .....	3	3.1 Guidance on the Use of This Standard .....	6
1.6.1 As Agreed Between User and Supplier (AABUS) .....	3	3.1.1 Conduct Risk Assessment .....	6
1.6.2 Authorized Supplier .....	3	3.1.2 Determine Traceability Level .....	6
1.6.3 Automated Data Collection / Data-Gathering Automation .....	4	3.1.3 Document Action in User Agreement .....	6
1.6.4 Batch Code .....	4	3.1.4 Monitor Risk / Update Traceability Level .....	6
1.6.5 Cell .....	4	3.2 Nonconforming Items .....	6
1.6.6 Cell Structure .....	4	3.3 Scope and Application of Traceability Recording .....	7
1.6.7 Common Materials .....	4	3.4 Requirement for Computerized Systems .....	7
1.6.8 Component .....	4	3.4.1 Internal Traceability Computerized System .....	7
1.6.9 Dashboard .....	4	3.4.2 External Traceability Computerized System .....	7
1.6.10 Data Integrity .....	4	<b>4 LEVELS OF TRACEABILITY</b> .....	8
1.6.11 Date Code .....	4	4.1 Levels of Internal Traceability .....	8
1.6.12 Lot Number .....	4	4.1.1 Material and Process Traceability Levels .....	8
1.6.13 Manual Data Management .....	4	4.2 Levels of External Traceability .....	9
1.6.14 Material Traceability .....	4	4.2.1 Material and Process Traceability Levels .....	10
1.6.15 Materials .....	4	4.3 Guideline for Anti-counterfeit Use .....	10
1.6.16 Mechanical Assembly .....	4	4.4 Guidelines for Classification and Internal Traceability Levels .....	10
1.6.17 Process Identification (ID) .....	4	4.5 Guidelines for Classification and External Traceability Levels .....	11
1.6.18 Process Traceability .....	4	<b>5 CELL STRUCTURE AND CONTENTS</b> .....	12
1.6.19 Product Build Records .....	4	5.1 Assembly Cell .....	13
1.6.20 Production Lot .....	4	5.2 Work-Order Information Cell .....	15
1.6.21 Raw Materials .....	4	5.3 Bill of Materials Cell .....	15
1.6.22 Risk .....	4	5.4 Material Traceability Cell .....	15
1.6.23 Risk Analysis .....	4	5.4.1 Unique Material/Subassembly Traceability Cell .....	16
1.6.24 Risk Assessment .....	4		
1.6.25 Risk Management .....	5		
1.6.26 Serial Number .....	5		

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
<b>6</b>	<b>EXTERNAL TRACEABILITY (SECURE SUPPLY CHAIN)</b> .....	<b>27</b>
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
<b>APPENDIX A</b>	<b>Acronym Index</b> .....	<b>34</b>

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