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IPC-2584

Sectional Requirements for Implementation of Printed Board Fabrication Data Description



Endorsed by the International
Electronics Manufacturing
Initiative (iNEMI)

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Developed by the CAD/CAM Convergence Subcommittee (2-17) of the
Data Generation and Transfer Committee (2-10) of IPC

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

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Sectional Requirements for Implementation of Printed Board Fabrication Data Description

INTRODUCTION

This standard is part of the IPC-2580 series of standards. These standards specify a data file format used to describe printed board and printed board assembly products with details sufficient for tooling, manufacturing, assembly, inspection and testing requirements. The format may be used for transmitting information between a printed board designer and a manufacturing or assembly facility. The files are also useful when the manufacturing cycle includes computer-aided processes and numerical control machines.

The IPC-2580 format requirements are provided in a series of standards focused on design printed board fabrication, assembly, inspection, and testing. This standard series consists of a generic standard (IPC-2581) which contains all the general requirements. There are seven sectionals that are focused on the details necessary to accumulate information in a single file that addresses the needs of the manufacturing disciplines producing a particular product.

The sectional standards (IPC-2582 through 2588) paraphrase the important detailed requirements and provide suggested usage and examples for the topic covered by the sectional standard. The information can be used for both manual and for digital interpretations. The data is defined in either English or International System of Units (SI) units.

1 SCOPE

This standard (IPC-2584) provides the information on the manufacturing requirements used for fabricating printed boards. This standard determines the XML schema details, defined in the generic standard (IPC-2581) and some of the 2580 sectional standards that are required to accomplish the focused tasks. When other standards are invoked, their requirements become a mandatory part of the fabrication details as defined in the IPC-2581.

1.1 Intent

The IPC-2581 contains all the requirements necessary to build an electronic product. The cardinality indicated in the IPC-2581 may be superseded by a restriction of an attribute (enumerated string ID) or indication of a requirement that is noted as being optional in the generic standard, however this standard makes the requirement mandatory based on the supply chain communication need.

In order to assist the users of this standard, all the applicable XML schema elements that apply to the Board Fabrication Function are listed in Appendix A. The list is grouped by topics and shows the Absolute Path for the elements that pertain to the focus of this standard. If the Parent element is not present no children are to be considered in the implementation, however all Attributes identified for a particular element **shall** follow the cardinality of the IPC-2581 unless a restriction is stated in this standard.

1.2 Interpretation

"**Shall**", the emphatic form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is mandatory. Deviation from a **shall** requirement is not permitted, and compliance testing is required in order to demonstrate that the XML instances are correct according to the W3C directives and this standard. The XML schema **shall** be the method to check syntax and semantics. Any appropriate software tool that prompts the user, to correct the ambiguity or to insert missing information, may be used for this purpose.

The words "should" and "may" are used whenever it is necessary to express non-mandatory provisions.

"Will" is used to express a declaration of purpose.

To assist the reader, the word **shall** is presented in bold characters

2 APPLICABLE DOCUMENTS

The following documents contain requirements which, when referenced, constitutes provisions of IPC-2584. At the time of publication, the editions indicated were valid. All documents are subject to revision and parties entering into agreements based on this standard are encouraged to investigate the possibility of applying the most recent additions of the documents indicated below.

The revision of the document in effect at the time of solicitation **shall** take precedence.

IPC-T-50	<i>Terms and Definitions for Interconnecting and Packaging Electronic Circuits.</i>
IPC-2581	<i>Generic Requirements for Printed Board Assembly Products Manufacturing Description Data and Transfer Methodology</i>
IPC-2582	<i>Sectional Requirements for Implementation of Administrative Methods for Manufacturing Data Description</i>
IPC-2583	<i>Sectional Requirements for Implementation of Drawing Methods for Manufacturing Data Description</i>
IPC-2588	<i>Sectional Requirements for Implementation of Part List Product Data Description</i>
IPC-2589	<i>Sectional Requirements - Activity Model for Printed Board Assembly Products Manufacturing</i>
IPC-2614	<i>Sectional Requirements for Board Fabrication Documentation</i>
IPC-7351	<i>Surface Mount Design & Land Patterns</i>

3 REQUIREMENTS

The requirements of IPC-2581 are a mandatory part of this standard. That document describes the generic requirements for the converged GenCAM and ODB++ formats. The generic details specifically provide data related to design, printed board manufacturing, assembly and test.

The XML schema of the 2581 consists of six major Elements each of which have several children who then become new parent elements. Several of these major elements and their associated new parents are defined in other sectionals thus the requirements of those standards, IPC-2582, IPC-2583, and IPC-2588 are also a mandatory part of the board fabrication standard to the extent of their description and any restrictions contained in this standard.

Each of the standards and the elements defined therein has a specific function or task respectively, and although they may at times be used independently, they become an important addition to the requirements of the board fabrication descriptions. As such the following paragraphs provide the total requirements for the three types of board fabrication files that are supported by the principles of the IPC-2581.

Accordingly, the information interchange for the specific purpose of printed board fabrication is only possible if all the XML instances have been properly prepared for such a purpose.

3.1 Terms and Definitions

The definition of all terms **shall** be in accordance with IPC-T-50 and the following. A term number at the end of a line indicates that it is a reproduction from IPC-T-50 to assist the reader in interpretation of this standard.

3.1.1 Data

Intelligent information that may be used directly by machine in order to accomplish a particular manufacturing event.

3.1.2 Drawings

Hard copy or un-intelligent documentation (e.g. PDF) to which all formatting criteria apply.

3.1.3 Printed Circuit Board

A composite of organic and inorganic material with external and internal wiring allowing electronic components to be mechanically supported and electrically connected. The accepted acronym is **PCB**.

3.1.4 Supplier

The organization or company responsible for providing the goods and/or services required to produce an electronic product which includes physical items as well as intellectual/software characteristics and is documented as either user procurement, supplier data or contractual agreements.

3.1.5 User

The individual, organization, company or agency responsible for the procurement of electrical/electronic hardware, and having the authority to define the class of equipment and any variation or restrictions (i.e., the originator/custodian of the contract detailing these requirements).

3.1.6 Via

An opening in the dielectric layer(s) through which a conductor passes upwards or downwards to subsequent chip or package conductive layers for electrical interconnections or for heat transfer.

3.2 Categories and Content

Table 3-1 provides the major functions that **shall** be addressed by the 2584 standard. The descriptions relate to the appropriate printed board fabrication processes. There are fifteen (15) unique functions that can be defined by the use of the XML elements and the resulting XML instances.

Table 3-1 indicates the relationships of the requirements for various elements and topics within the descriptions for a particular process. The letter "**M**" signifies a *mandatory* requirement. The letter "**O**" signifies an *optional* characteristic that may or may not be pertinent to the particular file or data interchange. A dash signifies an extraneous section (unnecessary). Although software tools used to parse the file will permit the extraneous data, it is recommended that only the requirements identified as mandatory or optional are included in the file in order to reduce file size transfer.

Table 3-1 Function Relationship of a 2580 Fabrication File

Name	Fabrication			Comment and Standard Reference
	1	2	3	
File Content Descriptions	M	M	M	Elements indicated in IPC-2582 according to cardinality of IPC-2581 and restrictions of this standard
Logistic Descriptions	M	M	M	
File History Descriptions	O	M	M	
BOM (Board Fabrication Materials)	M	M	M	Elements indicated in IPC-2588 according to cardinality of IPC-2581 and restrictions of this standard
AVL (Board Material Suppliers)	-	M	M	
Miscellaneous Image Layers	-	O	O	Elements indicated in IPC-2583 according to cardinality of IPC-2581 and restrictions of this standard
Documentation Layers	O	M	M	
Design for eXcellence (Dfx) Analysis	O	O	O	
Component Packages *	-	-	O	Elements indicated in this sectional standard, according to cardinality of IPC-2581 and any restrictions contained in the following paragraphs of this standard *Although Component Packages and Land Patterns are further defined in IPC-2586, and Net Lists are further defined in IPC-2587, their XML schemas are repeated in this standard.
Land Patterns *	-	-	O	
Soldermask, Legend Layers	M	M	M	
Drilling and Routing (Tooling) Layers	M	M	M	
Net List (Soft tooling) *	O	M	M	
Outer Conductive Layers	M	M	M	
Inner Conductive Layers	M	M	M	
Board Construction	M	M	M	

It should be understood that without a Net List it is difficult to verify that the produced board meets the design intent.

The correlation between the various descriptions identified in this standard are indicated in Figure 3-1. This shows the relationship of test coupons, individual board, phototools, etc. The illustration identifies those characteristics that are available in the CAD tools and are usually transferable to the CAM station. The left hand side illustrates combinations of the design intent including assembly characteristics and embedded components. Some of these concepts are important for a 2584 FAB1, FAB2 or FAB3 file and are illustrated for the board manufacturing processes shown on the right hand side of the illustration.

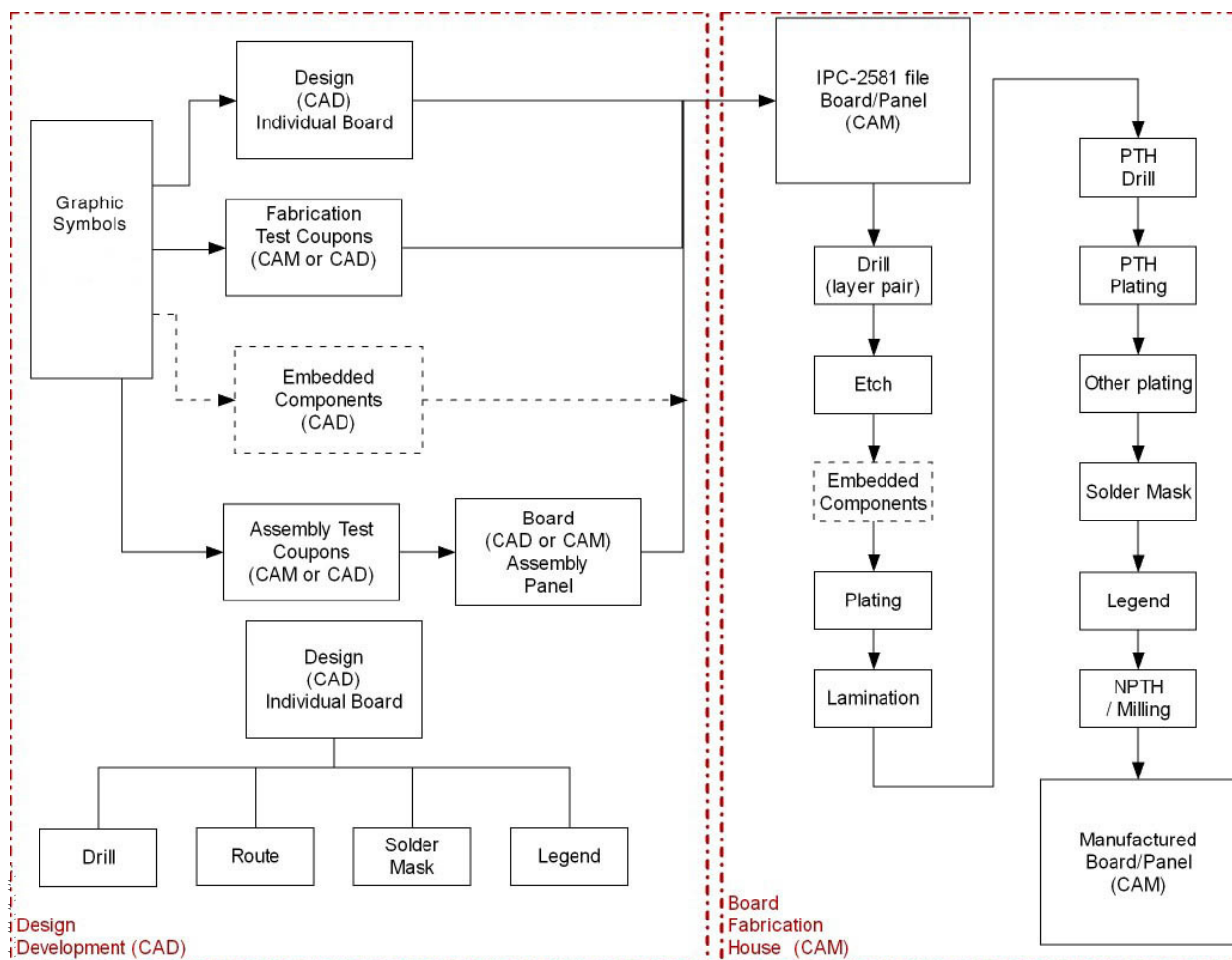


Figure 3-1 Board fabrication data relationship

4 GENERAL RULES

The following details reflect the rules used in describing the printed board characteristics in order to meet the requirements for board fabrication. These rules are intended to meet the needs of the manufacturer to understand the customer requirements. Wherever necessary, additional requirements have been detailed to reflect precision.

The attributes and rules described in IPC-2581 are required. Wherever necessary, detailed descriptions or definitions of the entities, attributes or characteristics are reproduced as defined in 2581 in an attempt to clearly define the mandatory descriptions.

4.1 File Content Descriptions

The File Content Descriptions **shall** be in accordance with IPC-2582. This is a mandatory requirement for all FAB layers, FAB1, FAB2, and FAB3.

The only restriction in **Content** is that a **BomRef** is mandatory (1-1) in that a **Bom** for board material description must appear in the 2584 file.

IPC-2581/Content/BomNameRef=1

4.2 Logistic Descriptions

All requirements for the Logistic Descriptions **shall** be in accordance with IPC-2582. The only restriction that exists is that if the file will be used as a transfer of information outside of the domain that creates the file. In that instance, the `RoleRef` attribute of `Person` must exist and is no longer optional.

IPC-2581/LogisticHeader/Person@RoleRef=1

It is a requirement that the `Role` name is one of the 8 enumerated strings listed in IPC-2582 with a recommendation that if no other obvious name exists, the name `SENDER` should be used.

IPC-2581/LogisticHeader/Role@name=SENDER

It should be understood that the sender of the file may not actually have electronic means to add data or modify the existing XML schema instance. If a dialog occurs between the sender and receiver of the data, a verification should be made to establish file hierarchy and modification capability at either end.

4.3 File History Descriptions

All requirements for the History Descriptions are in accordance with IPC-2582. The restrictions are slightly different for the various fabrication levels and pertain to:

FAB1 has no restrictions and meets all requirements of IPC-2582.

FAB2 takes the `changeRecord` and makes it a mandatory requirement (1-n instead of 0-n).

FAB3 requires that `changeRecord` and the `Approval` element are a mandatory part of the instance file.

IPC-2581/HistoryRecord/ChangeRec=1-n

IPC-2581/HistoryRecord/ChangeRec/Approval=1-n

Figure 4-1 provides a case study of the HistoryRecord. The figure and subsequent paragraphs show the trend in communication between design at the OEM level and manufacturing.

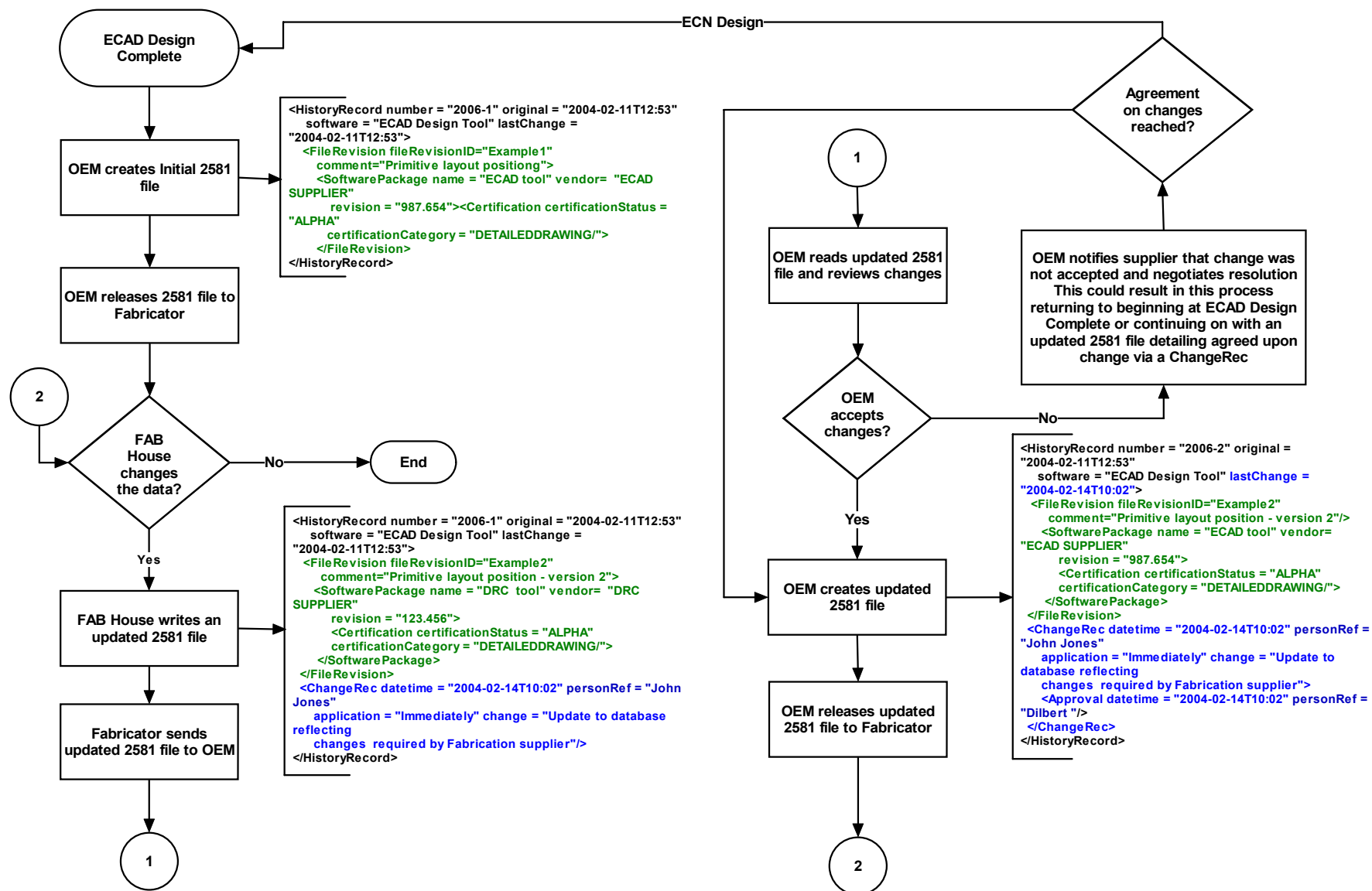


Figure 4-1 HistoryRecord Use Case

4.3.1 HistoryRecord Use Case – Initial Design Release

The EDA Design Tool creates the initial IPC-2581 file with the LogisticHeader, HistoryRecord and the HistoryRecord child FileRevision elements.

4.3.1.1 Logistic Header

The LogisticHeader contains the contact information for the OEM personnel who have defined roles for the design project. There are many methods for getting contact information into the EDA tool for export to an IPC-2581 file. These methods will range from manual manipulation such as using a dynamic dialog box to automatically importing from a contacts.xml file or corporate database.

The Role name and Person name shall be unique names. The Person name may be an actual name, such as John Smith; title, such as Senior Designer; or department name, such as Purchasing Department.

Ideally, the ability to import all preferred supplier information from external sources will be available in order to include preferred suppliers in the LogisticHeader element. Below is a sample of the minimum data necessary for a complete LogisticHeader element with optional fields populated.

```
<LogisticHeader>
  <Role name = "OEM Account Manager" description = "OWNER"
    publicKey = "x3d8rf7ko90mKMC07" authority = "OEM purchasing
    agent"/>
  <Enterprise id = "OEM" name = "Design House" code="34567"
    codeType = "DUNS" address1 = "123 Avenue Street " city =
    "Bigcity" stateProvince = "PV" country = "US" postalCode =
    "99999-1111" phone = "888-555-1212" fax = "888-555-1212"
    email="purchasing@oem.com" url = "http://www.oem.com" />
  <Person name="Purchasing Manager" enterpriseRef = "OEM" title =
    "Senior Purchasing Manager" email =
    "purchasing.manager@oem.com" phone = "888-555-1212ext123"
    fax = "888-555-1212" roleRef = "OEM Account Manager" />
</Logistic Header>
```

4.3.1.2 HistoryRecord

The HistoryRecord is the location of log type information for maintaining revision control of the IPC-2581 file for a design's life cycle. This does not mean that the entire history is present in any IPC-2581. It does give the OWNER a data record, which could be exported to a corporate database.

The EDA tool shall create a HistoryRecord for each IPC-2581 file by providing a means to enter the HistoryRecord number and the FileRevision fileRevisionID. This data could be entered by manual manipulation such as using a dynamic dialog box.

```
<HistoryRecord number = "2006-1" original = "2004-02-11T12:53"
  software = "ECAD Design Tool" lastChange = "2004-02-11T12:53">
  <FileRevision fileRevisionID="12345ENG-0"
    comment="Primitive layout position">
    <SoftwarePackage name = "ECAD tool" vendor= "ECAD
    SUPPLIER"
      revision = "987.654">
      <Certification certificationStatus = "ALPHA"
        certificationCategory = "DETAILEDDRAWING/">
```