



*THE INSTITUTE FOR
INTERCONNECTING
AND PACKAGING
ELECTRONIC CIRCUITS*

ANSI/IPC-D-350

Printed Board Description in Digital Form

A joint standard developed by Technical Committee 52 of the International Electrotechnical Commission (IEC) and the Computerized Data Format Standardization Subcommittee (2-11) of the Data Generation and Transfer Committee (2-10) of the Institute for Interconnecting and Packaging Circuits.

This document bears two reference numbers, and may be obtained from the IPC, the IEC, or ANSI. IPC-D-350D and IEC 1182-1 are identical in technical content.

The IEC version of this document also contains a French translation. The IEC is responsible for the accuracy of that translation.

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

Contact:

IPC
2215 Sanders Road
Northbrook, Illinois
60062-6135
Tel 847 509.9700
Fax 847 509.9798

IEC Central Office
3, rue de Varembe
PO Box 131 - 1211 Geneva 20
Switzerland

Table of Contents

1.0 SCOPE	1	5.10 Parameter TOL.....	10
1.1 Format Compatibility.....	1	5.11 Parameter SCALE.....	12
2.0 APPLICABLE DOCUMENTS	1	5.12 Parameter LAYER.....	12
2.1 IPC.....	1	5.13 Parameter IMAGE.....	13
2.2 American National Standards Institute.....	1	5.14 Parameter FAB.....	15
2.3 Department of Defense.....	1	5.15 Parameter AREA.....	18
2.4 International Electrotechnical Commission (IEC) International Standards Organization.....	1	6.0 COMMENT RECORDS	18
3.0 TERMS AND DEFINITIONS	1	6.1 Allowable Character Set.....	18
3.1 Annotation Record.....	2	6.2 Use of End-Of-Record.....	20
3.2 Comment Record.....	2	6.3 Comment Records Utilizing 2-Byte Characters.....	20
3.3 Composite Records.....	2	7.0 DATA RECORD FORMAT	20
3.4 Data Information Module (DIM).....	2	7.1 General Information.....	20
3.5 Data Layer.....	2	7.2 Operation Code Description Area.....	21
3.6 Data Record(s).....	2	7.3 Feature Description Area (FDA).....	23
3.7 Datum Reference.....	2	7.4 Location Description Area (LDA) (Columns 31–72).....	24
3.8 Feature.....	2	7.5 Unassigned Columns.....	26
3.9 Field.....	2	8.0 REQUIREMENTS FOR LINE RECORDS	26
3.10 General Record.....	2	8.1 Operation Codes.....	27
3.11 Job Set.....	2	8.2 FDA Area.....	28
3.12 Line Record(s).....	2	8.3 LDA Field Definition (Columns 31–72).....	30
3.13 Modal Form.....	2	8.4 Unassigned Columns (Columns 73–80).....	31
3.14 Parameter Record.....	2	9.0 Requirements for POINT Records	31
3.15 Point Record.....	2	9.1 Operation Code Definition (Columns 1–3).....	31
3.16 Physical Layer.....	2	9.2 Feature Description Area (Columns 4–30).....	31
3.17 Record.....	2	9.3 LDA Field Definition (Columns 31–72).....	33
3.18 Subroutine Definition Record.....	2	9.4 Unassigned Columns (Columns 73–80).....	33
3.19 Subroutine Call Record.....	2	10.0 REQUIREMENTS FOR ANNOTATION RECORDS	33
4.0 GENERAL REQUIREMENTS	2	10.1 Operation Codes (Columns 1–3).....	33
4.1 Data Hierarchy.....	2	10.2 Feature Description Area (FDA) (Columns 4–30).....	33
4.2 Basic Record Types.....	3	10.3 “LDA” Field Definition (Columns 31–72).....	34
4.3 Record Format.....	3	10.4 Continuation Records (Columns 4–72).....	35
4.4 Data Set Descriptions.....	4	10.5 Unassigned Column (Columns 73–80).....	35
4.5 Data Orientation.....	4	11.0 REQUIREMENTS FOR SUBROUTINE DEFINITION RECORDS	35
4.6 Transfer Media and Data Formats.....	4	11.1 Operation Code Definition (Columns 1–3).....	36
5.0 PARAMETER RECORDS	6	11.2 Feature Description Area (Columns 4–30).....	36
5.1 Parameter JOB.....	6	11.3 LDA Field Definition.....	37
5.2 Parameter FORM.....	6	11.4 Unassigned Columns (Columns 73–80).....	38
5.3 Parameter CODE.....	7	12.0 SUBROUTINE CALL RECORDS	38
5.4 Parameter DIM (Data Information Module).....	7	12.1 Operation Code Definition (Columns 1–3).....	38
5.5 Parameter UNITS.....	7	12.2 Feature Description Area (Columns 4–30).....	41
5.6 Parameter TITLE.....	8		
5.7 Parameter NUM.....	8		
5.8 Parameter REV.....	9		
5.9 Parameter LANG.....	9		

12.2 LDA Definition (Columns 31-72)..... 42

13.0 FEATURE LIBRARIES AND ANSI ASCII CHARACTER SET 46

13.1 Primary and Secondary Side Designations 46

13.2 Standard Feature Libraries—D2000 and D3000 Series 46

13.3 Standard Feature Library—D4000 Series 46

13.4 Special Shape Library 47

13.5 Allowable Character Set 47

Appendix A Summation of IPC-D-350 Record Formats 54

Appendix B Terms and Definitions from IPC-T-50.. 65

Appendix C Terms and Definitions from IEC 194... 66

Figure 12-1 Example of multilevel cells associated with a complex problem 40

Figure 12-2 SUBROUTINE record format for linear replication 41

Figure 12-3 Example of linear repeat of complex pattern subroutines..... 43

Figure 12-3a Coding for Figure 12-3: Linear repeat..... 44

Figure 12-4 Rotary replication—calculation of resultant locations..... 45

Figure 13-1 Primary and secondary side designations 46

Figure 13-2 Standard feature library—D2000 and D3000 series 48

Figure 13-3 Standard feature library—D4000 Series 49

Figure 13-4a IPC Special Shape Library 50

Figure 13-4b IPC Special Shape Library 51

Figure 13-4c IPC Special Shape Library 52

Figure 13-4d IPC Special Shape Library 53

Figures

Figure 4-1 Hierarchy of data in a job set..... 3

Figure 4-2 Printed board viewing..... 5

Figure 5-1 Parameter JOB..... 6

Figure 5-2 Parameter FORM 6

Figure 5-3 Parameter CODE 7

Figure 5-4 Parameter DIM 7

Figure 5-5 Parameter UNITS..... 8

Figure 5-6 Parameters TITLE, NUM, and REV 10

Figure 5-7 Parameter LANG..... 10

Figure 5-8 Parameter TOL 11

Figure 5-9 Parameter SCALE 13

Figure 5-10 Parameter LAYER 13

Figure 5-11 Parameter IMAGE 13

Figure 5-12 Example 1: Positive IMAGE (dark features show non-conductive areas) 14

Figure 5-13 Example 2: Format for Negative IMAGE (non-conductive areas are transparent) 14

Figure 5-14 Negative feature zone 15

Figure 5-15 Parameter FAB 16

Figure 5-16 Dielectric cross section..... 19

Figure 5-17 Parameter AREA 20

Figure 6-1 Examples of comment records (arrows illustrate end-of-record) 21

Figure 6-2 Example use of control characters in comment records..... 21

Figure 8-1 Linear and circular interpolation 27

Figure 8-2 Area “paint-in” 28

Figure 8-3 Part outlines..... 28

Figure 8-4 Sample computer printout 29

Figure 8-5 Line style code definition 30

Figure 10-1 Text orientation codes “0”-“7” 35

Figure 11-1 Shape definitions for subroutine column-2 codes “2” and “4”..... 37

Figure 11-2 LDA fields for special shape dimensions 39

Tables

Table 1-1 Correlation Between IPC-D-35X Standards and Record Formats 1

Table 4-1 Physical Layer Definitions 5

Table 4-2 Special Character Definition..... 5

Table 5-1 Native Language Codes..... 8

Table 5-2 Record Interrelationship 9

Table 5-3 Codes for “CUST” Units 9

Table 5-4 Codes for Revision Levels of IEC/IPC Standards 10

Table 5-5 Tolerance Applications 11

Table 5-6 Scale Codes 13

Table 5-7 Material and Thickness Codes..... 17

Table 5-8 Area Parameter Codes 19

Table 7-1 Major Areas of Data Records..... 21

Table 7-2 Operation Code Descriptions 22

Table 7-3 Column-1 Operation Codes 23

Table 7-4 FDA Fields..... 24

Table 7-5 FDA Fields Summary (Fixed Format) 25

Table 8-1 LINE Record LDA Fields Significance for Column-2 Operation Codes 27

Table 9-1 POINT Record Column-2 Operation Codes 31

Table 9-2 Plating Options 32

Table 9-3 Feature Shape..... 32

Table 10-1 FDA Field Summary for ANNOTATION Records 33

Table 10-2 34

Table 10-3 Rotation Code Description for ANNOTATION Records 34

Table 11-1 LDA Field Options for Subroutines 38

Table 12-1 LDA Coordinate Definitions for Linear Replication..... 41

Table 12-2 LDA Coordinate Definitions for Rotary Replication..... 41

Table 13-1 Allowable Character Set..... 47

Printed Board Description in Digital Form

1.0 SCOPE

This standard specifies record formats used to describe printed board products with detail sufficient for tooling, manufacturing and testing requirements. These formats may be used for transmitting information between a printed board designer and a manufacturing facility. The records are also useful when the manufacturing cycle includes computer-aided processes and numerically controlled machines.

The information can be used for both manual and for digital interpretation. The data may be defined in either English or SI units.

1.1 Format Compatibility The concepts detailed in this standard may be supplemented by descriptions defined in other companion IPC Standards. It is the intent that a family of standards be developed with applicability for various record formats.

Data redundancy shall be kept to a minimum by using companion standards for appropriate data descriptions, depending upon the use of the data. The following shows the correlation between standards and record formats that are to be defined:

Table 1-1 Correlation Between IPC-D-35X Standards and Record Formats

IPC-D-35X Standards	Record Description
IPC-D-350	Artwork Records
IPC-D-350	Board Description Records
IPC-D-351	Schematic Drawing Records
IPC-D-351	Master Drawing Records
IPC-D-351	Assembly Drawing Records
IPC-D-351	Miscellaneous Part Drawing Records
IPC-D-352	Electrical Description Records
IPC-D-352	Parts List Records
IPC-D-354	Library Description Records
IPC-D-356	Bare Board Electrical Test Information

2.0 APPLICABLE DOCUMENTS

The following documents of the issue currently in effect form a part of this standard to the extent specified herein.

2.1 IPC¹

IPC-T-50 Terms and Definitions

IPC-D-310 Suggested Guidelines for Artwork Generation and Measurement Techniques for Printed Circuits

IPC-D-354 Library Format Description for Printed Board Digital Data Bases

IPC-D-390 Automated Design Guidelines

2.2 American National Standards Institute²

ANSI X3/TR-1-77 American National Directory for Information Processing

ANSI X3.4 Standard Code for Information Exchange

ANSI X3.12 Subroutine Record Format Standardization

ANSI X3.22 Recorded Magnetic Tape for Information Interchange

ANSI X3.26 Hollerith Punched Card Code

ANSI X3.39 Recorded Magnetic Tape

ANSI X3.54 Recorded Magnetic Tape

ANSI Z210.1 Metric Practice Guide (ASTM E380-72)

2.3 Department of Defense³

W-T-0051 Tape, Electronic Data Processing, 1971

2.4 International Electrotechnical Commission (IEC)⁴ International Standards Organization⁴

IEC Publication 194 Terms and Definitions for Printed Circuits

ISO Publication 646 Information Processing. ISO 7-Bit Coded Character Set for Information Exchange

3.0 TERMS AND DEFINITIONS

Unless otherwise specified herein, terms and definitions shall be in accordance with IPC-T-50, IEC 194, ANSI X3.12 and the definitions in the following paragraphs. Useful terms from the referenced standards are reprinted in Appendix B and C to assist in the understanding of this document.

1. To obtain documents, write: IPC, 2215 Sanders Road, Northbrook, IL 60062-6135

2. To obtain documents, write: American National Standards Institute, 1430 Broadway, New York, NY 10018

3. To obtain documents, write: Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

4. To obtain documents, write: (ISO or IEC) Central Office, 3 Rue De Varembe, P.O. Box 131, 1211 Geneva 20, Switzerland