



ECAD/MCAD COLLABORATION
Implementation Guidelines

prostep ivip Recommendation

ECAD/MCAD Collaboration
Implementation Guidelines

prostep ivip
Documentation

Referring to PSI 5

ECAD/MCAD Collaboration Implementation Guidelines

Version 4.5, 01/09/2020

Status: released



Abstract

This Implementation Guideline accompanies the prostep ivip PSI5 Recommendation for ECAD/MCAD-Collaboration.

Disclaimer

Prostep ivip Certification Guidelines (PSI Certification Guidelines) are available for general use. Anyone using these recommendations is responsible for ensuring that they are used correctly.

This PSI Certification Guidelines gives due consideration to the prevailing state-of-the-art at the time of publication. Anyone using PSI Certification Guidelines must assume responsibility for his or her actions and acts at their own risk. The prostep ivip Association and the parties involved in drawing up the PSI Certification Guidelines assume no liability whatsoever.

We request that anyone encountering an error or the possibility of an incorrect interpretation when using the PSI Recommendation should contact the prostep ivip Association (psi-issues@prostep.com) immediately so that any errors can be rectified.

Copyright

- I. All rights on this PSI Documentation, in particular the copyright rights of use and sale such as the right to duplicate, distribute or publish the Documentation remain exclusively with the prostep ivip Association and its members.
- II. The PSI Documentation may be duplicated and distributed unchanged, for instance for use in the context of creating software or services.
- III. It is not permitted to change or edit this PSI Documentation.
- IV. A suitable notice indicating the copyright owner and the restrictions on use must always appear.

Acknowledgment

Our thanks go to all the companies and their staff who were actively involved in drafting this recommendation and for the many constructive suggestions received. The following companies and research institutes were involved:

Cenit, Continental, Delphi, :em engineering methods, Fern Universität Hagen, Fraunhofer IPK, Mentor Graphics, Parametric Technology, PD Tec, PROSTEP AG, Siemens PLM Software, Universität Karlsruhe, xPLM Solution, Cadence, CAD/CAM Group, Dassault Systèmes.

Contents

Table of Contents

1 General	9
1.1 Objectives of the Implementation Guidelines	9
1.2 Document structure.....	9
2 Overview of use cases	10
2.1 Use cases covered within implementation guidelines	10
2.2 Test cases.....	11
3 Introduction to the IDX protocol.....	12
3.1 Typical Workflows	14
3.1.1 Basic IDX Workflow	14
3.1.2 Enhanced IDX Workflows	15
4 Representation of an <i>EDMDataSet</i> in XML	17
4.1 Representation of an Item	18
4.1.1 Defining an Item's position in the z-Axis	20
4.1.2 Using the correct classification for an item	24
4.1.3 Marking Items as Non-collaborative.....	28
5 IDX Message Types	30
5.1 The "SendInformation" message	30
5.2 The "SendChanges" message.....	31
5.2.1 Sending Proposed Changes using "SendChanges"	31
5.2.2 Responding to Proposed Changes using "SendChanges"	37
5.3 Timestamps in IDX messages	39
5.4 Transaction History in IDX messages.....	41
5.5 Sending IDX Messages as Files.....	43
5.5.1 File Suffix.....	43
5.5.2 Use of message file compression (*.idz).....	43
5.5.3 File Naming and Folder Usage	43
6 How to model specific ECAD features in IDX.....	44
6.1 How to model the Board	45
6.1.1 Describing a simple Board in IDX	45
6.1.2 Describing Boards in terms of their Layers	48
6.2 How to model Components	70
6.3 How to model Mounting Holes (Plated and non-plated).....	84
6.3.1 Describing a hole in IDX: "Traditional" method	84
6.4 How to model a Milled Cutout (Plated and non-plated).....	89
6.5 How to model Keep-Out and Keep-In areas.....	93
6.6 How to model Placement Group areas.....	98
6.7 How to model "Other Outlines" or User areas	100

6.8 How to represent Traces, Copper areas and Silkscreen.....	103
6.9 Summary of all Item Types	109
6.10 Mapping IDF Items to IDX Items.....	114
7 Describing Geometry in IDX.....	115
7.1 Representing the shape of an item in “2.5 D”	115
7.1.1 XML representation of an <i>EDMDArc</i>	120
7.1.2 XML representation of an <i>EDMDBSplineCurve</i>	121
7.1.3 Instantiation of an <i>EDMDCircle3Point</i>	122
7.1.4 XML representation of an <i>EDMDCircleCenter</i>	123
7.1.5 XML representation of an <i>EDMDEllipse</i>	124
7.1.6 XML representation of an <i>EDMDParabola</i>	125
7.1.7 XML representation of an <i>EDMDPolyLine</i>	126
7.1.8 XML representation of an <i>EDMDCompositeCurve</i>	127
7.1.9 Representation of the shape of an item as external file.....	128
7.1.10 XML representation of items of a PCB board (example)	129
8 Instantiation of test cases	132
8.1 Test Case 1-1: “Support of shape representations”	132
8.2 Test Case 1-2: “Definition of board baseline B”	132
8.3 Test Case 2-1: Addition of new items (Change 1).....	133
8.4 Test case 2-2: Removal of items (Change 2)	134
8.5 Test case 2-3: Movement of items (Change 3)	135
8.6 Test case 2-4: Modification of items (Change 4).....	136
8.7 Test case 2-5: Replacement of items (Change 5).....	137
9 Terms for IDX properties	139

Figures

Figure 1 Structure of implementation guidelines	9
Figure 2: Use Cases covered within implementer guidelines	10
Figure 3: Types of communication	12
Figure 4: Typical Workflow	14
Figure 5: Structure of DataSet section	17
Figure 6: Overview on section giving advice on how items should be instantiated in IDX schema.....	18
Figure 7: Representation of two instances of a PCB package in IDX.....	19
Figure 8: Representation of instances of board components.....	19
Figure 9: XSD schema for an item	20
Figure 10: Cross section of board showing Z range values	21
Figure 11: Description of an item instance	22
Figure 12: Example PCB board with components and design features.....	22
Figure 13: Possible instantiation of a PCB board.....	23
Figure 14: Three “parameters” for classifying an item using the ‘original’ method	24
Figure 15: XML representation of SendInformation message (root).....	30
Figure 16: Representation of a proposed change (here: Movement of a component)	31
Figure 17: XML representation of SendChange message	32
Figure 18: Definition of a single proposed change.....	32
Figure 19: Overview of SendChanges message in XML	33
Figure 20: Example for instantiation of the "Changes" section	34
Figure 21: Description of items in “change” section is done in “Dataset” section	35
Figure 22: Addition of ‘DeletedInstanceName’ object to indicate item to be deleted.....	36
Figure 23: Addition of ‘Accept’ object in ‘Response’ file.....	37
Figure 24: A cross-section of a typical PCB showing the layer structure or Layer “Stackup”	48
Figure 25: A cross-section of a typical flex-rigid board	49
Figure 26: Example of a flexible board in its 'flexed' state	50
Figure 27 Connecting boards using flexible bands	57
Figure 28: Describing a flexible area of board as bend.....	60
Figure 29: Representation of a "milled cut-out"	89
Figure 30: Interpretation of unbound lower/upper bound of keep-out.....	93
Figure 31: Example for representation of traces in IDX	104
Figure 32: Representation of a shape of an item by combine several “translation bodies” (“OR” operator)	115
Figure 33: Usage of upper/lower bound and thickness	116
Figure 34: Instantiation of combination of “translation bodies” (example)	116
Figure 35: Representation of a shape of an item by “cut-out” another body (“NAND” operator).....	117
Figure 36: Describe a closed curve of by combination of several other curves.....	117
Figure 37: Body with a composite curve as footprint	118
Figure 38: XML representation of an arc.....	120

Figure 39: XML representation of a B-Spline	121
Figure 40: XML representation of a circle described by three points	122
Figure 41: XML representation of a circle described by center point and diameter	123
Figure 42: XML representation of an Ellipse	124
Figure 43: XML representation of a parabola	125
Figure 44: XML representation of a polyline	126
Figure 45: XML representation of a composite curve	127
Figure 46: XSD schema for representing the shape of an item as external file	128
Figure 47: Instantiation for implicit representation of an item's shape	128
Figure 48: Overview: Instantiation of the board	129
Figure 49: XML representation of a mounting hole	130
Figure 50: Representation of a board with components	131
Figure 51: Verify support of different kinds of "explicit" shape representation	132
Figure 52: Verify definition of initial base line which contains main item types for collaboration	133
Figure 53: Verify addition of new items	134
Figure 54: Verify removal of items from board	135
Figure 55: Verify movements of items	136
Figure 56: Verify modification of items	137
Figure 57: Verify replacement of items	138



Tables

Table 1: Test cases for certification process 11

Table 2: IDX ItemShape classes and their detailed types..... 26

Table 3: Values for “classification parameters” of an item supported by current implementations..... 27

Table 4: User property names and IDXv4.0 Geometry Types for Physical Layers..... 51

Table 5: Supported hole types in IDXv4.0..... 88

Table 6: Supported keepout types from IDXv4.0 97

Table 7: Supported keepin types from IDXv4.0 97

Table 8: Summary of all Item Types..... 113

Table 9: Mapping of IDF Items to IDX Items 114

Table 10: Overview on available curve types..... 119

Table 11: Property names and units to be used (created on the terms used in IDF 3.0) 140