

IPC/DAC-2552

2022 - July

General Electronic Components Model Based Definition (MBD) Standard

An international standard developed by IPC



BUILD ELECTRONICS BETTER

Full document details: IPC DAC 2552-2022



The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

Standards Should:

- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

Standards Should Not:

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

Notice

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

IPC Position Statement on Specification Revision Change

It is the position of IPC's Technical Activities Executive Committee that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC publication is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision. Adopted October 6, 1998

Why is there a charge for this document?

Your purchase of this document contributes to the ongoing development of new and updated industry standards and publications. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC's volunteers in the standards and publications development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC's staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC's membership dues have been kept low to allow as many companies as possible to participate. Therefore, the standards and publications revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards and publications, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/597-2872.

Thank you for your continued support.



IPC/DAC-2552

General Electronic Components Model Based Definition (MBD) Standard

Developed by the Model Based Definition (MBD) for Digital Twins Task Group (2-12b) of the Electronic Product Data Description Committee (2-10) of IPC and the Digital Association of China (DAC)

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

Contact:

IPC
3000 Lakeside Drive, Suite 105 N
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105



This Page Intentionally Left Blank

Acknowledgment

Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the Model Based Definition (MBD) for Digital Twins Task Group (2-12b) of the Electronic Product Data Description Committee (2-10) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of IPC extend their gratitude.

(2-10) Electronic Product Data Description Committee	(2-12b) Model Based Definition (MBD) for Digital Twins Task Group	Technical Liaison of the IPC Board of Directors
Chair Michael Ford Aegis Software	Co-Chairs Victor Xu Huawei Technologies Co. Ltd. Shuming Gao Zhejiang University Zhiqian Sang Hangzhou Dianzi University Radu Diaconescu Swissmic Vice Chairs Shengjie Qian Vayo (Shanghai) Technology Co., Ltd. Yujian Shen New H3C Technologies Co., Ltd.	Bob Neves Microtek (Changzhou) Laboratories

IPC recognizes this A-Team for their exceptional leadership and effort in the development of this standard.

Model Based Definition (MBD) for Digital Twins A-Team

Zhiman Chen ZHUZHOU CRRC TIMES ELECTRIC CO., LTD	Shengjie Qian Vayo (Shanghai) Technology Co., Ltd.	Wei Wang New H3C Technologies Co., Ltd.
Shuming Gao Zhejiang University	Zhiqian Sang Hangzhou Dianzi University	Victor Xu Huawei Technologies Co. Ltd
Roc Han Technology and Engineering Center for Space Utilization, Chinese Academy of Scie	Yujian Shen New H3C Technologies Co., Ltd.	Keliang Xue ZWSOFT CO., LTD.(Guangzhou)
Zhaohua Hu	Jason Sun Huawei Cloud Computing Technologies Co., Ltd.	Xiangyu Zeng PISX (Shanghai) Co., Ltd.
Chunguang Huang Shenzhen Dianchao Technology Co., Ltd.	Li Wan Huazhong University of Science & Technology	Lvquan Zhang Huawei Machine Co., Ltd.
	Chenpeng Wang Huawei Technologies Co. Ltd	Daoyun Zhu Caxa Technology Co., Ltd.

(2-12b) Model Based Definition (MBD) for Digital Twins Task Group

Edward Acheson Cadence Design Systems Inc.	Tao Ding Beijing University of Technology	Stephen Golemme JITX Inc.
Zhiman Chen ZHUZHOU CRRC TIMES ELECTRIC CO., LTD	Michael Durkan Mentor Graphics Corporation	Roc Han Technology and Engineering Center for Space Utilization, Chinese Academy of Science
Radu Diaconescu Swissmic	Michael Ford Aegis Software	Terry Hoffman Cisco Systems Inc.
	Shuming Gao Zhejiang University	

Ife Hsu Intel	Lim Ming Jabil Circuit Sdn. Bhd.	Chenpeng Wang Huawei Technologies Co. Ltd
Zhaohua Hu	Sylvain Perron Cogiscan Inc.	Chuandong Wang New H3C Technologies Co., Ltd.
Chunguang Huang Shenzhen Dianchao Technology Co., Ltd.	Shengjie Qian Vayo (Shanghai) Technology Co., Ltd.	Wei Wang New H3C Technologies Co., Ltd.
Dana Korf Nano Dimension	Zhiqian Sang Hangzhou Dianzi University	Jarrold Webb Lockheed Martin Missiles & Fire Control
Craig Lax Septillion Technologies	Yujian Shen New H3C Technologies Co., Ltd.	Victor Xu Huawei Technologies Co. Ltd
Geoffrey Leeds Insulectro	Simon Smith Pillarhouse International, Ltd.	Keliang Xue ZWSOFT CO., LTD.(Guangzhou)
Jinsong Lin PISX (Shanghai) Co. Ltd.	Bhanu Sood NASA Goddard Space Flight Center	Xiangyu Zeng PISX (Shanghai) Co. Ltd.
Charlie Liu OPS Excellence Consulting	Jason Sun Huawei Cloud Computing Technologies Co., Ltd.	Lvquan Zhang Huawei Machine Co., Ltd.
Thomas Marktscheffel ASM Assembly Systems GmbH & Co. KG	Li Wan Huazhong University of Science & Technology	Daoyun Zhu Caxa Technology Co., Ltd.
Zohair Mehkri Flextronics International		

Table of Contents

1	SCOPE	1	6.4.5	Component Mounting Positioning Label	13
1.1	Purpose	1	6.4.6	Part and Module Label	13
1.1.1	Application of This Standard	1	6.4.7	Design Constraint Geometry Label	13
1.2	Classification	1	6.4.8	Body Conductive Area Label	15
1.3	Definition of Requirements	1	6.4.9	Other Geometry Label	15
1.4	Order of Precedence	1	6.5	Weight Information	15
1.4.1	Conflict	2	6.6	Packaging Information	15
1.4.2	Clause References	2	6.7	Process Requirement Information	15
1.5	Abbreviations and Acronyms	2	6.7.1	Assembly Mode	15
1.6	Terms and Definitions	2	6.7.2	SMT Process Requirements	15
1.7	Use of “Lead”	2	6.7.3	THT Process Requirements	16
2	APPLICATION DOCUMENTS	2	6.7.4	Hotbar Process Requirements	17
2.1	IPC	2	6.7.5	Press-Fit Process Requirements	17
2.2	Joint Standards	2	6.7.6	Screw Installation Process Requirements	18
2.3	ASTM International	2	6.8	Risk Sensitivity Information	18
2.4	EIA	2	6.9	Packing Information	19
2.5	ISO	2	6.10	Environmental Information	23
2.6	JEDEC	3	6.11	Storage Information	23
2.7	The World Wide Web Consortium (W3C)	3	6.12	Vendor Information	23
3	PRINCIPLES FOR BUILDING COMPONENT MBD MODEL	3	6.13	Naming Convention for MBD Files	23
4	CLASSIFICATION OF GENERAL ELECTRONIC COMPONENTS	3	6.14	Example	23
4.1	Classification by Function	3	6.14.1	Example 1: Chip Component	23
4.2	Classification by Assembly Mode	4	6.14.2	Example 2: BGA chip	28
4.3	Classification by Lead Type	4	6.14.3	Example 3: Connector	33
5	MODEL COMPOSITION INFORMATION	9	7	DATA FORMAT – XML SCHEMA	36
5.1	Component Physical Geometry	9	7.1	General Data Type	36
5.1.1	Component Lead Geometry	9	7.1.1	Cartesian_point Type	36
5.1.2	Component Body Geometry	10	7.1.2	Direction Type	36
5.1.3	Coloring for Body Geometry	12	7.1.3	Axis2_placement_3d Type	37
5.2	Design Constraint Geometry	12	7.1.4	Toleranced_value Type	37
6	MODEL SEMANTIC INFORMATION	12	7.1.5	Geometry_pointer Type	39
6.1	Unit System Information	12	7.1.6	Unit_enum Type	39
6.2	Dimension and Tolerance Information	12	7.1.7	SI_prefix_enum Type	40
6.3	Material Information	13	7.1.8	Float_with_unit Type	41
6.4	Geometric Label Information	13	7.1.9	Toleranced_value_with_unit Type	41
6.4.1	PIN Number Label	13	7.2	IPC-2552 Element	42
6.4.2	Deformable Part Label	13	7.2.1	Physical_composition_type Type	43
6.4.3	Component Polarity Identification	13	7.2.2	Design_constraint_geometry_type Type	54
6.4.4	Component Orientation Identifier	13	7.2.3	Size_and_tolerance Type	56
			7.2.4	Geometry_and_material Type	57
			7.2.5	Geometry_labels_type Type	58

7.2.6	Weight_type Type	60
7.2.7	Packaging_enum Type	60
7.2.8	Technology_requirement_by_mounting Type	60
7.2.9	Risk_sensitive_info_type Type	65
7.2.10	Packing_type Type	69
7.2.11	Environment_info_type Type	74
7.2.12	Storage_info_type Type	74
7.2.13	Supplier_info_type Type	75
7.3	Storage Format of the MBD File	75
7.3.1	File Header	76
7.3.2	Data Composition Files	76
7.3.3	Data Checksum	76

APPENDIX A – Abbreviations and Acronyms 77

Figures

Figure 4-1	Chip Components	4
Figure 4-2	BGAs	4
Figure 4-3	Gull Wing Leads	5
Figure 4-4	J-Type Lead	5
Figure 4-5	Inverted J-Type Lead	5
Figure 4-6	I-Type Lead	6
Figure 4-7	L-Type Lead (Outward)	6
Figure 4-8	L-Type Lead (Inward)	7
Figure 4-9	Flat Lug Leads	7
Figure 4-10	Through-Hole Lead	7
Figure 4-11	Press-Fit Lead	7
Figure 4-12	Leadless Type	8
Figure 4-13	Screw Type	8
Figure 4-14	Hybrid Lead 1	8
Figure 4-15	Hybrid Lead 2	9
Figure 4-16	Hybrid Lead 3	9
Figure 5-1	Model Composition	9
Figure 5-2	Geometric Profile of BGA Components	10
Figure 6-1	Schematic Diagram of Pin Number Label	13
Figure 6-2	Schematic Diagram of Deformable Part Label	13
Figure 6-3	Schematic Diagram of Component Polarity Identification	14
Figure 6-4	Schematic Diagram of Component Orientation Identifier	14
Figure 6-5	Schematic Diagram of Component Mounting Positioning Label	14
Figure 6-6	Schematic Diagram of Part and Module Label	14

Figure 6-7	Schematic Diagram of Design Constraint Geometry Label	14
Figure 6-8	Schematic Diagram of Body Shape Conductive Area Label	14
Figure 6-9	Tray Length	19
Figure 6-10	Component Pin 1	20
Figure 6-11	Tape Hole Pitch	20
Figure 6-12	Tape Cavity Pitch	20
Figure 6-13	Tape Width	20
Figure 6-14	Silver Package Marking	21
Figure 6-15	Tin Package Marking	21
Figure 6-16	Moisture Grade Package Marking	21
Figure 6-17	Humidity Indicator Card	22
Figure 6-18	Model Geometry Schematic Diagram for Chip Components	24
Figure 6-19	Model Geometry Schematic Diagram for BGAs	28
Figure 6-20	Model Geometry Schematic Diagram for Connectors	33
Figure 7-1	Cartesian_point Type	36
Figure 7-2	Direction Type	37
Figure 7-3	Axis2_placement_3d Type	37
Figure 7-4	Value_with_deviation Type	38
Figure 7-5	Value_with_limit Type	38
Figure 7-6	Value_with_percentage Type	38
Figure 7-7	Geometry_pointer Type	39
Figure 7-8	Float_with_unit Type	41
Figure 7-9	Toleranced_value_with_unit Type	41
Figure 7-10	IPC-2552 Element	42
Figure 7-11	Physical_composition_type Type	43
Figure 7-12	Leads_composition_type Type	43
Figure 7-13	Lead_index_mapping_standard Type	43
Figure 7-14	Lead_mapping_table Group and Lead_mapping_item Element	44
Figure 7-15	Lead_group_list Group and Lead_group Element	44
Figure 7-16	Single_lead_type Type	45
Figure 7-17	Pattern Type	45
Figure 7-18	Rectangular_pattern Type	45
Figure 7-19	Definition of the Parameters of Rectangular Pattern	46
Figure 7-20	Circular_pattern Type	47
Figure 7-21	Definition of the Parameters of Circular Pattern	47
Figure 7-22	General_pattern Type	48

Figure 7-23	Body_composition_type Type	48
Figure 7-24	Body_components_type Type	48
Figure 7-25	BGA_composition Type	49
Figure 7-26	Leadframe_composition Type	50
Figure 7-27	Other_substrate_composition Type	51
Figure 7-28	Connector_composition Type	52
Figure 7-29	Optical_device_composition Type	53
Figure 7-30	Design_constraint_geometry_type Type	54
Figure 7-31	Package_keepout_area_and_height Type	55
Figure 7-32	Package_keepout_space_3D Type	55
Figure 7-33	Hole_keepout_area_list Group and Hole_keepout_area Element	56
Figure 7-34	Design_constraint_geometry_list Group and Design_constraint_geometry Element	56
Figure 7-35	Size_and_tolerance Type	57
Figure 7-36	Geometry_and_material Type	57
Figure 7-37	Material_type Type	58
Figure 7-38	Stress_strain_property Type	58
Figure 7-39	Interpolation_table_list group and Interpolation_table Element	59
Figure 7-40	Point_list Group and Point Element	59
Figure 7-41	Geometry_labels_type Type	59
Figure 7-42	Label_item Type	60
Figure 7-43	Weight_type Type	60
Figure 7-44	SMT_technology Type	61
Figure 7-46	Hotbar_technology Type	63
Figure 7-47	Press-Fit_technology Type	64
Figure 7-48	Screw_assembly_technology Type	65
Figure 7-49	Risk_sensitive_info_type Type	65
Figure 7-50	Stress_sensitivity_type Type	67
Figure 7-51	Stress_type Type	67
Figure 7-52	Chemical_compatibility_type Type	67
Figure 7-53	Process_conditions_type Type	68
Figure 7-54	ESD_requirement_type Type	68
Figure 7-55	ESD_classification_type Type	68
Figure 7-56	Packing_type Type	70
Figure 7-57	Packing_requirement_on_ESD Type	73
Figure 7-58	ESD_requirement_for_intermediate_packing Type	73
Figure 7-59	ESD_requirement_for_direct_packing_material Type	74
Figure 7-60	Environment_info_type Type	74
Figure 7-61	Storage_info_type Type	74
Figure 7-62	Supplier_info_type Type	75

Tables

Table 4-1	Classification By Function	3
Table 4-2	Classification by Assembly Mode	4
Table 4-3	Classification by Lead Type	4
Table 5-1	Geometric Hierarchy of Component Leads	10
Table 5-2	Geometric Hierarchy of Component Body	10
Table 5-3	Body Geometry of BGA Type Components	11
Table 5-4	Body Geometry of Lead-Frame Type Components	11
Table 5-5	Body Geometry of Other Substrate-Based Components	11
Table 5-6	Body Geometry of Connectors	11
Table 5-7	Body Geometry of Optic	12
Table 5-8	Geometric Hierarchy of Design Constraints	12
Table 6-1	Dimension and Tolerance Information	13
Table 6-2	Material Information	13
Table 6-3	Packaging Types	15
Table 6-4	SMT Process Requirements	16
Table 6-5	THT Process Requirements	16
Table 6-6	Hotbar Process Requirements	17
Table 6-7	Press-Fit Process Requirements	17
Table 6-8	Screw Installation Process Requirements	18
Table 6-9	Risk Sensitivity Information	18
Table 6-10	Packing Information	19
Table 6-11	Environmental Information	23
Table 6-12	Storage Information	23
Table 6-13	Naming Convention	23
Table 6-14	Model Geometry Hierarchy for Chip Components	24
Table 6-15	Model Semantic Information for Chip Components	24
Table 6-16	Model Geometry Hierarchy for BGAs	29
Table 6-17	Model Semantic Information for BGAs	29
Table 6-18	Model Geometry Hierarchy for Connectors	33
Table 6-19	Model Semantic Information for Connectors	33
Table 7-1	Cartesian_point Type	36
Table 7-2	Direction Type	37
Table 7-3	Axis2_placement_3d Type	37
Table 7-4	Parameter of Toleranced_value Type	37
Table 7-5	Value_with_deviation Type	38
Table 7-6	Value_with_limit Type	38
Table 7-7	Value_with_percentage Type	38



Table 7-8	Geometry_pointer Type	39	Table 7-46	Packaging_enum Type Enumerations	60
Table 7-9	Unit_enum Type Enumerations	39	Table 7-47	SMT_technology Type	61
Table 7-10	SI_prefix_enum Type Enumerations	40	Table 7-48	THT_technology Type	62
Table 7-11	Float_with_unit Type	41	Table 7-49	Hotbar_technology Type	63
Table 7-12	Toleranced_value_with_unit Type	41	Table 7-50	Press-Fit_technology Type	64
Table 7-13	IPC-2552 Element	42	Table 7-51	Screw_assembly_technology Type	65
Table 7-14	Physical_composition_type Type	43	Table 7-52	Risk_sensitive_info_type Type	65
Table 7-15	Leads_composition_type Type	43	Table 7-53	Temperature_sensitivity_enum Type Enumerations	66
Table 7-16	Lead_index_mapping_standard Type	43	Table 7-54	Moisture_sensitivity_enum Type Enumerations	66
Table 7-17	Lead_mapping_table Group and Lead_mapping_item Element	44	Table 7-55	Stress_sensitivity_type Type	67
Table 7-18	Lead_group_list Group and Lead_group Element	44	Table 7-56	Stress_type Type	67
Table 7-19	Single_lead_type Type	45	Table 7-57	Chemical_compatibility_type Type	67
Table 7-20	Pattern Type	45	Table 7-58	Process_conditions_type Type	68
Table 7-21	Rectangular_pattern Type	45	Table 7-59	ESD_requirement_type Type	68
Table 7-22	Circular_pattern Type	47	Table 7-60	ESD_classification_type Type	68
Table 7-23	General_pattern Type	48	Table 7-61	HBM_enum Type Enumerations	69
Table 7-24	Body_composition_type Type	48	Table 7-62	CDM_enum Type Enumerations	69
Table 7-25	Body_components_type Type	48	Table 7-63	Packing_type Type	70
Table 7-26	BGA_composition Type	49	Table 7-64	Packing_standard_enum Type Enumerations	71
Table 7-27	Leadframe_composition Type	50	Table 7-65	Packing_type_enum Type Enumerations	72
Table 7-28	Other_substrate_composition Type	51	Table 7-66	Pin1_position_enum Type Enumerations	72
Table 7-29	Connector_composition Type	52	Table 7-67	Packing_vacumn_degree_enum Type Enumerations	72
Table 7-30	Optical_device_composition Type	53	Table 7-68	Baking_requirement_enum Type Enumerations	72
Table 7-31	Design_constraint_geometry_type Type	54	Table 7-69	Long_term_heat_resistance_enum Type Enumerations	72
Table 7-32	Package_keepout_area_and_height Type	55	Table 7-70	Packing_requirement_on_ESD Type	73
Table 7-33	Package_keepout_space_3D Type	55	Table 7-71	ESD_requirement_for_intermediate_packing Type	73
Table 7-34	Hole_keepout_area_list group and Hole_keepout_area Element	56	Table 7-72	ESD_requirement_for_direct_packing_material Type	74
Table 7-35	Hole_type_enum Enumerations	56	Table 7-73	Environment_info_type Type	74
Table 7-36	Design_constraint_geometry_list group and Design_constraint_geometry Element	56	Table 7-74	Storage_info_type Type	74
Table 7-37	Size_and_tolerance Type	57	Table 7-75	Storage_humidity_level_enum Type Enumerations	75
Table 7-38	Geometry_and_material Type	57	Table 7-76	Storage_temperature_level_enum Type Enumerations	75
Table 7-39	Material_type Type	58	Table 7-77	Package_vacumn_degree_enum Type Enumerations	75
Table 7-40	Stress_strain_property Type	58	Table 7-78	Supplier_info_type Type	75
Table 7-41	Interpolation_table_list group and Interpolation_table Element	59	Table 7-79	Structure of IPC-2552 File Header	76
Table 7-42	Point_list Group and Point Element	59			
Table 7-43	Geometry_labels_type Type	59			
Table 7-44	Label_item Type	60			
Table 7-45	Weight_type Type	60			

General Electronic Components Model Based Definition (MBD) Standard

1 SCOPE

This standard defines the set of specification elements for components and parts to be assembled and connected onto printed boards. These specification elements mainly cover the component specifications in strong correlation with board-level manufacturing (e.g., SMT, THT, Press-Fit), assembly and board-level reliability.

1.1 Purpose This standard provides a digital model-based standard defined to realize efficient and high-quality digital design of board-level assembly (e.g., mounting, assembly, reliability) and to support the final realization of virtual manufacturing of electronic assembly.

1.1.1 Application of This Standard This standard is applicable to components and parts to be mounted and assembled on printed boards. These components mainly include passive components (e.g., RC, soldered structural parts), discrete components (e.g., transistors), IC, on-board connectors, RF components, optical components, etc.

The potential uses of data from this standard will be applicable to, for example, printed board layout, DFX, SMT machine data libraries, operation documentation, incoming material inspection, material purchasing decision-making, printed board CAD to 3D-CAD conversion, etc.

The implementation of this standard is based on the 3D model of components, and on this basis, the key specification elements to be included in the 3D model of components are defined.

The key specification elements defined in this standard are derived from the requirements of board-level design and simulation activities, with the purpose of achieving better DFX (design for manufacturability, assembly and reliability) characteristics. This standard mainly focuses on the structure, material and process characteristic parameters of components related to board-level manufacturing process and long-term application.

1.2 Classification IPC standards recognize that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in manufacturability, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is Required, and for which uninterrupted service is desired but not critical. Typically, the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when Required, such as life support or other critical systems.

1.3 Definition of Requirements The words **shall** or **shall not** are used in the text of this document wherever there is a requirement for materials, preparation, process control or acceptance.

The word “should” reflects recommendations and is used to reflect general industry practices and procedures for guidance only.

Line drawings and illustrations are depicted herein to assist in the interpretation of the written requirements of this Standard. The text takes precedence over the figures.

1.4 Order of Precedence The contract **shall** take precedence over this standard, referenced standards and drawings.

In the event of conflict, the following order of precedence applies:

- 1) Procurement as agreed and documented between user and supplier.
- 2) Master drawing, design brief or tech pack reflecting the user’s detailed requirements.
- 3) When invoked by the customer or per contractual agreement, this standard.

When documents other than this standard are cited, the order of precedence **shall** be defined in the procurement documents.

The user can specify alternate acceptance criteria.

1.4.1 Conflict In the event of conflict between the requirements of this standard and the applicable drawing(s) and documentation, the applicable user-approved drawing(s) and documentation govern.

Some examples of documentation include the contract, purchase order, technical data package, engineering specification or performance specification. In the event of a conflict between the text of this standard and the applicable documents cited herein, the text of this standard takes precedence. In the event of conflict between the requirements of this standard and drawing(s) and documentation that has not been user approved, this standard governs.

1.4.2 Clause References When a clause in this document is referenced, its subordinate clauses apply, unless the requirement references specific subordinate clauses.

1.5 Abbreviations and Acronyms See Appendix A for full spellings of abbreviations (including elements) and acronyms used in this standard.

1.6 Terms and Definitions The definitions of terms used in this standard are in accordance with IPC-T-50.

1.7 Use of “Lead” For readability and translation, this document uses the noun lead only to describe leads of a component. The metallic element lead is always written as Pb.

2 APPLICATION DOCUMENTS

2.1 IPC¹

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-A-610 Acceptability of Electronic Assemblies

2.2 Joint Standards²

IPC/JEDEC J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies

ANSI/ESDA/JEDEC JS-001 Human Body Model Testing of Integrated Circuits

JS-002 ANSI/ESDA/JEDEC Joint Standard for Electrostatic Discharge Sensitivity Testing – Charged Device Model (CDM) – Device Level

IPC/JEDEC J-STD-006 Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

IPC/JEDEC J-STD-020 Moisture/Reflow Sensitivity Classification for Nonhermetic Surface Mount Devices

IPC/JEDEC J-STD-033 Handling, Packing, Shipping and Use of Moisture, Reflow, and Process Sensitive Devices

IPC/JEDEC J-STD-075 Classification of Non-IC Electronic Components for Assembly Processes

2.3 ASTM International³

ASTM F1249 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

2.4 EIA⁴

EIA 481 8 mm Through 200 mm Embossed Carrier Taping and 8 mm & 12 mm Punched Carrier Taping of Surface Mount Components for Automatic Handling

2.5 ISO⁵

ISO 10303-42 Industrial automation systems and integration – Product data representation and exchange – Part 42: Integrated generic resource: Geometric and topological representation

ISO 10303-203 Industrial automation systems and integration – Product data representation and exchange – Part 203: Application protocol: Configuration controlled 3D design of mechanical parts and assemblies

ISO 10303-214 Industrial automation systems and integration – Product data representation and exchange – Part 214: Application protocol: Core data for automotive mechanical design processes

ISO 10303-242 Industrial automation systems and integration – Product data representation and exchange – Part 242: Application protocol: Managed model-based 3D engineering

¹ www.ipc.org

² www.ipc.org / www.jedec.org

³ www.astm.org

⁴ www.eclanow.org

⁵ www.iso.org

ISO/TS 10303-1514 Industrial automation systems and integration – Product data representation and exchange – Part 1514: Application module: Advanced boundary representation

ISO/IEC 9834-8 Information technology – Procedures for the operation of object identifier registration authorities – Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers

2.6 JEDEC⁶

JEDEC SPP-010 Grid Array Terminal Position Numbering

JEDEC SPP-012 Pin #1 Mark and Lead-Numbering Convention for Dual-In-Line Packages with Standard and Reverse-Bend Lead Form

JEDEC SPP-024 Reflow Flatness Requirements for Ball Grid Array Packages

JESD 30 Descriptive Designation System for Semiconductor-device Packages

JEP30-E100 Part Model Electrical Guidelines for Electronic-Device Packages – XML Requirements

JEDEC JESD 77 Terms, Definitions, and Letter Symbols for Discrete Semiconductor and Optoelectronic Devices

2.7 The World Wide Web Consortium (W3C)⁷

Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C Recommendation

XML Schema Part 1: Structures Second Edition, W3C Recommendation

XML Schema Part 2: Datatypes Second Edition, W3C Recommendation

3 PRINCIPLES FOR BUILDING COMPONENT MBD MODEL

General principles:

- 1) Component MBD model should consists of component's 3D geometry model and its corresponding semantic information
- 2) Component MBD model's 3D geometry model should be built by means of assembly modeling and in the format of STP file.
- 3) The semantic information structure should follow this standard's section 7 and in xml format.

Principles for defining necessity of MBD model contents:

Required: The part of the 3D geometry model, or the item of the semantic information is mandatorily required to be presented in the component's MBD model

Required Conditionally: If the part of the 3D geometry model exists, or the item of the semantic information is necessarily to be provided, the part or the item is mandatorily required to be presented in the component's MBD model.

Other: In general, the items defined in this standard should or conditionally should be presented, except for those items are clearly marked to be presented as of AABUS.

4 CLASSIFICATION OF GENERAL ELECTRONIC COMPONENTS

4.1 Classification by Function The board-level assembly components can be classified into three types, as shown in Table 4-1.

Table 4-1 Classification By Function

Level1	Level2	Remarks
Electrical	BGA type electrical Lead-frame-based electrical Other-substrate-based electrical Other electrical	Refer to JEP30-E100 for the classification of components. Generally, electrical include: Passive components: resistors, capacitors, inductors, transducers, diodes, electrical switches, passive RF components, etc. Active components: transistors, integrated circuits, batteries, active RF components, optoelectronic, etc.
Connector	Press-Fit type connector Soldering type BGA connector Other soldering type connector	None
Optic	Soldering type optic Other optic	None

⁶ www.jedec.org
⁷ www.w3.org

4.2 Classification by Assembly Mode For readability and translation, this document uses the noun lead only to describe leads of a component. The metallic element lead is always written as Pb.

Table 4-2 Classification by Assembly Mode

Assembly Mode	Description
SMT	The process technology of mounting components onto the printed board surface corresponding to the component leads and then achieving connection between components and printed board by heating methods such as reflow heating.
Through-Hole Reflow (THR)	The mounting and reflow processes are similar to SMT, except that holes corresponding to leads need to be designed on the printed board.
Wave Soldering	The processing technique by connecting components with the printed board by wave soldering.
Press-Fit	The processing technique by pressing component leads into the corresponding printed board holes.
Hotbar	The processing technique by connecting leads with the printed board by heating and pressurizing.
Iron Soldering	The processing technique by connecting components with the printed board using electric soldering iron as heat source.
Screw Mounting Type	The processing technique by connecting components with the printed board using screws. It is generally used for the interconnection of printed board and connectors with screws.

4.3 Classification by Lead Type The board-level component can be classified by lead type, as shown in Table 4-3.

Table 4-3 Classification by Lead Type

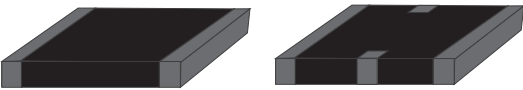
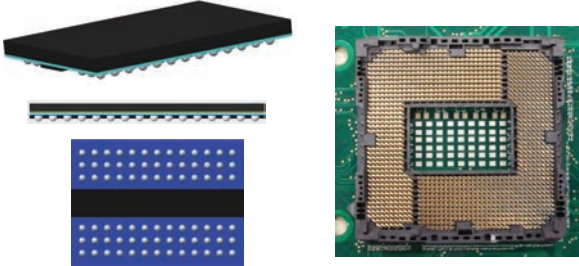
Packaging Type	Symbol	Graphics	Main Packaging Name/ Function Component
Chip Component	R	 Figure 4-1 Chip Components	Chip RC, including full terminal, half terminal, chip capacitor network, chip resistor network, three-terminal filter capacitor, etc.
BGA	B	 Figure 4-2 BGAs	Including PBGA, CGA, FCBGA, BGA connectors, etc.

Table 4-3 Classification by Lead Type (cont.)

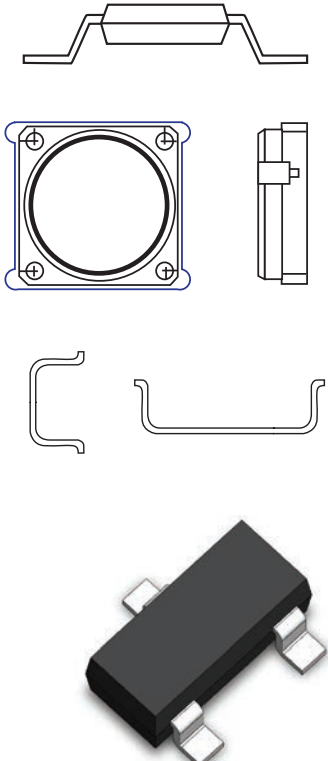
Packaging Type	Symbol	Graphics	Main Packaging Name/ Function Component
Gull Wing Lead	G	 Figure 4-3 Gull Wing Leads	Including SOT, SOP, and QFP part of RF components (e.g., circulator, power module), etc., shielding box, spiral coil
J-Type Lead	J	 Figure 4-4 J-Type Lead	Including part of J-type ICs and J-type inductors
Inverted J-Type Lead	J1	 Figure 4-5 Inverted J-Type Lead	Including part of J-type ICs and J-type inductors

Table 4-3 Classification by Lead Type (cont.)

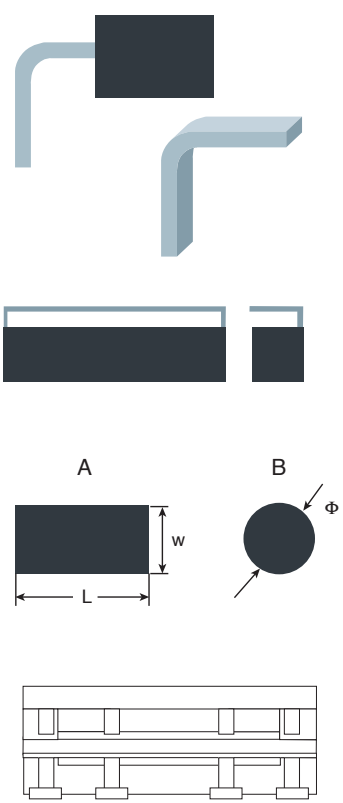
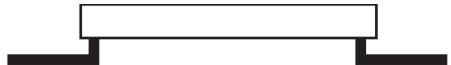
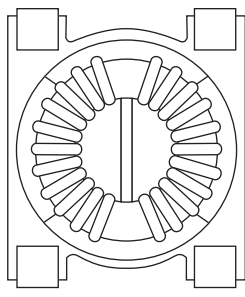
Packaging Type	Symbol	Graphics	Main Packaging Name/ Function Component
I-Type Lead	I	 The graphics for the I-Type Lead include three isometric views of the lead structure, a cross-sectional view of a rectangular lead labeled 'A' with dimensions 'L' (length) and 'w' (width), and a cross-sectional view of a circular lead labeled 'B' with diameter 'Φ'. Below these is a top-down view of a multi-lead package. Figure 4-6 I-Type Lead A – Rectangular cross section B – Circular cross section	Including ceramic dielectric filter, etc.
L-Type Lead (Outward)	L	 The graphic shows a cross-section of an L-Type Lead (Outward) package, featuring a central rectangular body with two outward-facing leads. Figure 4-7 L-Type Lead (Outward)	Including common mode inductors
L-Type Lead (Inward)	L1	 The graphic shows a top-down view of an L-Type Lead (Inward) package, which is a circular component with multiple inward-facing leads arranged radially. Figure 4-8 L-Type Lead (Inward)	Including common mode inductors

Table 4-3 Classification by Lead Type (cont.)

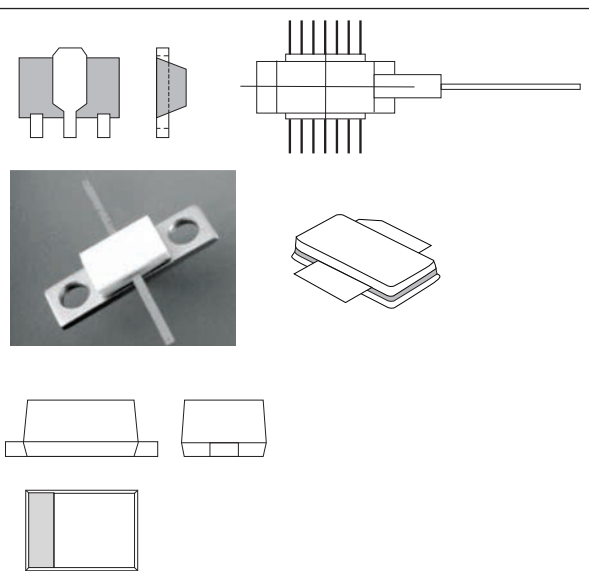
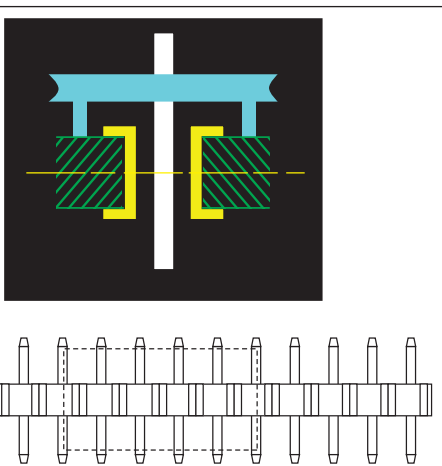
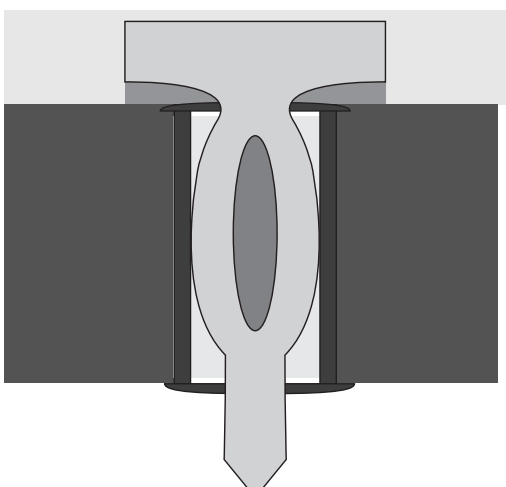
Packaging Type	Symbol	Graphics	Main Packaging Name/ Function Component
Flat Lug Leads (The lead extends straight out of the body, and the protruding part is formed without bending.)	F	 Figure 4-9 Flat Lug Leads	Including butterfly optical components, some SOTs, some RF components (e.g., RF high-power load resistor, RF fixed attenuator, power tube), diodes
Through-Hole Lead	T	 Figure 4-10 Through-Hole Lead	Including various kinds of THT components
Press-Fit Lead	PF	 Figure 4-11 Press-Fit Lead	Including various kinds of press-fit components, mainly press-fit connectors

Table 4-3 Classification by Lead Type (cont.)

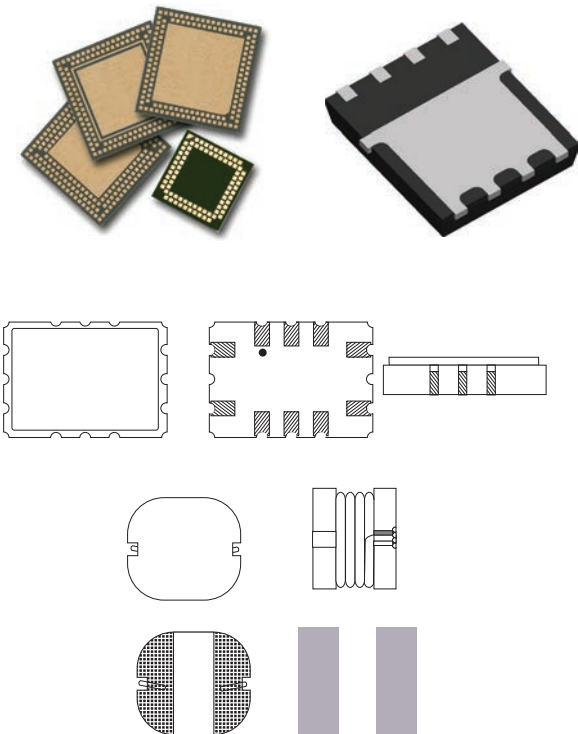
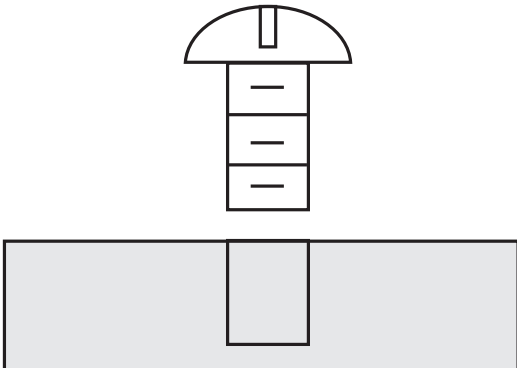
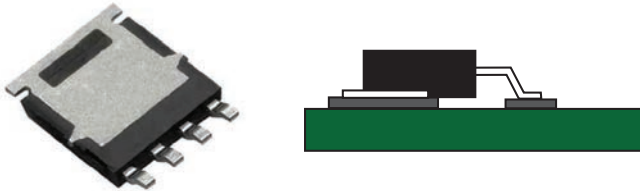
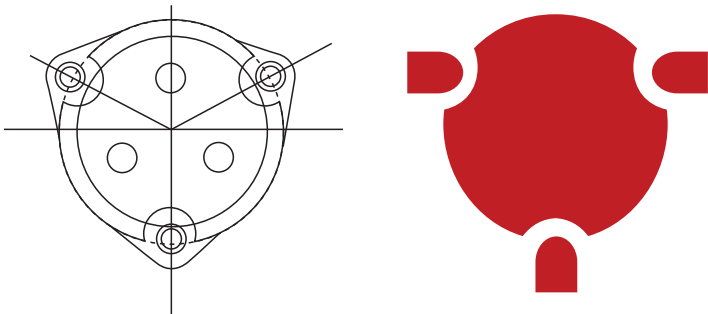
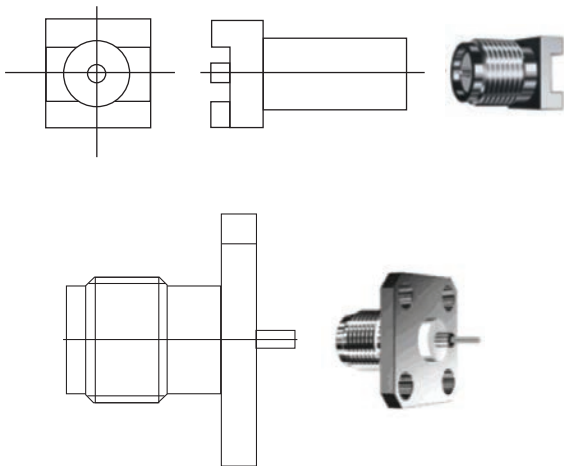
Packaging Type	Symbol	Graphics	Main Packaging Name/ Function Component
Leadless (The lead is at the bottom of the body, and the standoff embedded in the body is ≤ 0.1 mm.)	N	 Figure 4-12 Leadless Type	Including: QFN, LGA, BCC, some MOSFET and Castle-type components
Screw Type	Y	 Figure 4-13 Screw Type	Including: connectors assembled by screw
Hybrid Lead 1: No Lead + Gull Wing Lead	NG	 Figure 4-14 Hybrid Lead 1	MOSFET components

Table 4-3 Classification by Lead Type (cont.)

Packaging Type	Symbol	Graphics	Main Packaging Name/ Function Component
Hybrid Lead 2: No Lead + I-Type Lead	NI	 Figure 4-15 Hybrid Lead 2	Including D-PAK
Hybrid Lead 3: No Lead + Through Hole Lead	NT	 Figure 4-16 Hybrid Lead 3	Including RF coaxial connector, etc.

5 MODEL COMPOSITION INFORMATION

The geometry model of component MBD model should consist of the physical geometry model (1 and 2 in Figure 5-1) and the component design constraints (see 3 in Figure 5-1).

5.1 Component Physical Geometry This describes the geometric information of physical parts of the component, including the lead geometry and the body of the component. Constructive Solid Geometry convection STEP Advanced_brep_shape_representation (ISO/TS 10303-1514) **shall** be adopted.

5.1.1 Component Lead Geometry This describes the geometric part of the component directly connected with printed board (including nonfunction design), which can be subdivided into lead body and lead plating. The detailed hierarchical structure is as shown in Table 5-1.

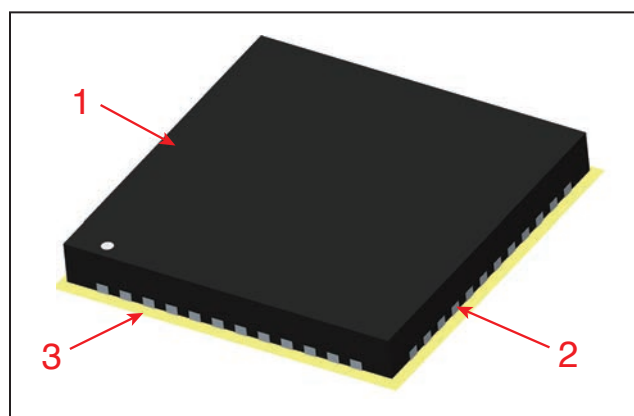


Figure 5-1 Model Composition

- 1 – Component body
- 2 – Component pins
- 3 – Design constraints (virtual mounting surfaces)

Table 5-1 Geometric Hierarchy of Component Leads

Lead geometry	Lead group	Single Lead geometry	Lead body geometry
			Plating geometry (Lead plating geometry or Substrate finish geometry)
		Distribution pattern	/
	(Multiple lead groups acceptable)	/	/

Note 1: The solder externally applied between the component and printed board is not a part of the component, so it should not be taken as part of the component lead.

Note 2: A layer of solder tin prefabricated on the deliverables of the component for the convenience of soldering should be taken as part of the component lead.

Note 3: The prefabricated solder ball on the BGA chip component should be taken as component lead.

Note 4: The post or hook designed for positioning should be taken as a special type of component lead.

Note 5: “/” in the table means there is no subtype.

5.1.2 Component Body Geometry This describes the other parts of the physical geometry of component other than the leads, which can be subdivided into body shape geometry, body positioning and installation geometry, and body components geometry. The detailed hierarchical structure is as shown in Table 5-2.

Table 5-2 Geometric Hierarchy of Component Body

Body geometry (Required)	Body shape geometry (Required)
	Body positioning and installation geometry (Required Conditionally)
	Geometry of body components (Required Conditionally)

The parts assisting adsorption such as adsorption cap, Mylar, **shall** be presented in the body geometry. The physical label of components **shall** be presented in the body geometry.

5.1.2.1 Body Geometry of BGA type components The parts that **shall** be presented in the body geometry of BGA type components (as illustrated in Figure 5-2) are listed in Table 5-3.

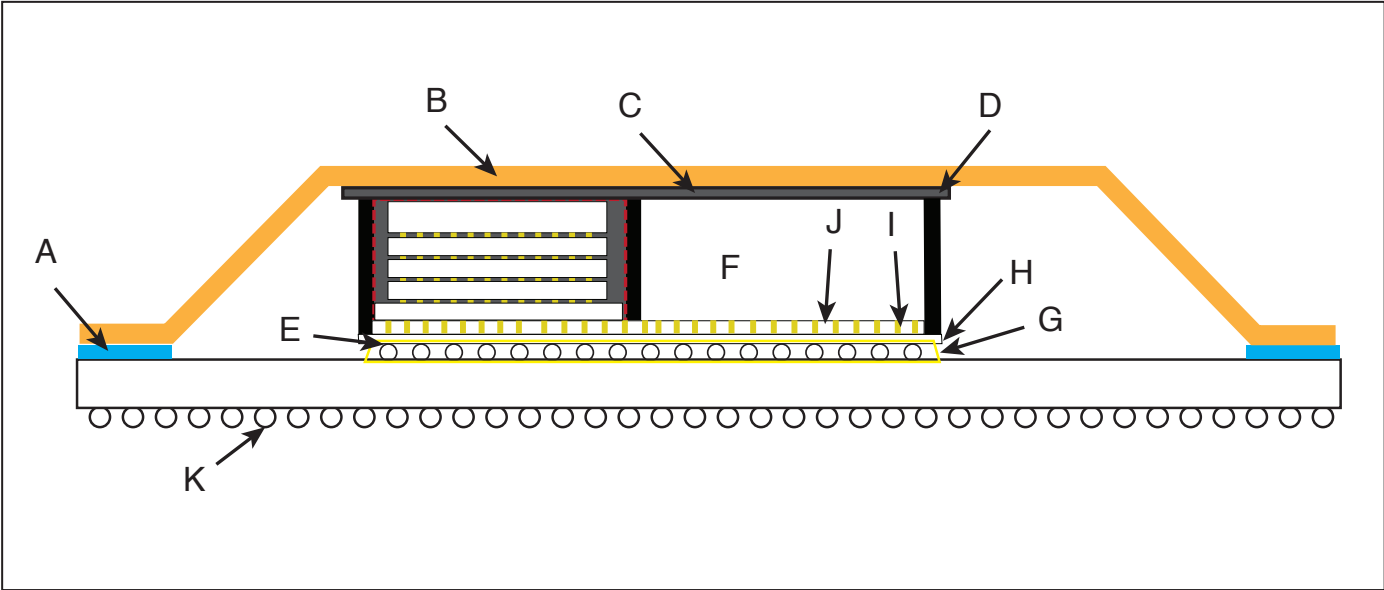


Figure 5-2 Geometric Profile of BGA Components

- A – Lid adhesive

B – Lid

C – Thermal interface material (TIM)
- D – Molding

E – C4 bump

F – Logic die

G – Underfill 1
- H – Interposer

I – μbump

J – Underfill 2

K – Solder ball

Table 5-3 Body Geometry of BGA Type Components

Body Geometry (Required)	Substrate (Required conditionally, when substrate exists in the physical component; it should be presented)
	RDL (Required conditionally, for WLCSP; it should be presented)
	Die (Required)
	Interposer (Required conditionally, when interposer exists in the physical component; it should be presented)
	Die attach (Required conditionally, when die attach exists in the physical component; it should be presented)
	Underfill (Required conditionally, when underfill exists in the physical component; it should be presented; different underfill at different location shall be distinguished)
	Bump (Required conditionally, when bump or microbump exists in the physical component; it should be presented)
	Lid (Required conditionally, when Lid or Ring exists in the physical component; it should be presented)
	Lid attach (Required conditionally, when lid attach exists in the physical component; it should be presented)
	Molding (Required conditionally, when molding exists in the physical component; it should be presented)
	TIM (Required conditionally, when TIM exists in the physical component; it should be presented)
	Other parts (Required conditionally, when other parts (e.g., capacitors) exist in the physical component; it should be presented)

5.1.2.2 Body Geometry of Lead-Frame Type Components The parts that **shall** be presented in the body geometry of Lead-Frame type components are listed in Table 5-4.

Table 5-4 Body Geometry of Lead-Frame Type Components

Body Geometry (Required)	Lead-frame (Required)
	Die (Required)
	Die attach (Required)
	Molding (Required conditionally, when molding exists in the physical component; it should be presented)
	Other parts (Required conditionally, when other parts (e.g., capacitors) exist in the physical component; it should be presented)

5.1.2.3 Body Geometry of Other Substrate-Based Components The parts that **shall** be presented in the body geometry of Other Substrate-Based components are listed in Table 5-5.

Table 5-5 Body Geometry of Other Substrate-Based Components

Body Geometry (Required)	Substrate (Required)
	Die (Required conditionally, when die exists in the physical component; it should be presented)
	Molding (Required conditionally, when molding exists in the physical component; it should be presented)
	EMC shielding layer (Required conditionally, when EMC shielding layer exists in the physical component; it should be presented)
	Other parts (Required conditionally, when other parts, e.g., capacitors, exist in the physical component; it should be presented)

5.1.2.4 Body Geometry of Connectors The parts that **shall** be presented in the body geometry of Connectors are listed in Table 5-6.

Table 5-6 Body Geometry of Connectors

Body Geometry (Required)	Housing (Required conditionally, when housing exists in the physical component; it should be presented)
	Picking-up cap (Required conditionally, when picking-up cap exists in the physical component; it should be presented)
	Cage (Required conditionally, when cage exists in the physical component; it should be presented)
	Embedded nut (Required conditionally, when embedded nut exists in the physical component; it should be presented)
	Screw (Required conditionally, when screw nut exists in the physical component; it should be presented)
	Cable (Required conditionally, when cable nut exists in the physical component; it should be presented)
	Golden finger (Required conditionally, when golden finger exists in the physical component; it should be presented)
	Organizer (Required conditionally, when organizer in the physical component; it should be presented)
	Attachment (Required conditionally, when attachment in the physical component; it should be presented)

5.1.2.5 Body Geometry of Optic The parts that **shall** be presented in the body geometry of Optic are listed in Table 5-7.

Table 5-7 Body Geometry of Optic

Body Geometry (Required)	FPC (Required conditionally, when FPC in the physical component; it should be presented)
	Adhesive for strengthening (Required conditionally, when adhesive for strengthening in the physical component; it should be presented)
	Holes for positioning (Required conditionally, when holes for strengthening in the physical component; it should be presented)
	Vias for solder wicking (Required conditionally, when optic are with FPC; it should be presented)
	Plate (Required for screw assembled optic)

5.1.3 Coloring for Body Geometry Body coloring **shall** meet the following:

- 1) Colors for each part in the body geometry **shall** be presented with RGB.
- 2) Each part's color **shall** reflect and be close to its physical appearance.
- 3) Color for different parts **shall** be distinguished from each other.
- 4) For a single part, each surface's color **shall** be distinguished if their physical appearance is different (i.e., for punched leads, if the end surface does not have surface plating, while the side surface has plating, these surface's color **shall** be distinguished).

5.2 Design Constraint Geometry This describes the geometry of the nonphysical part of the component used to describe the design constraints, such as the virtual mounting surface of the component, the package keep-out area, etc. See Table 5-8.

Table 5-8 Geometric Hierarchy of Design Constraints

Design Constraint Geometry (Required)	Virtual mounting surface of component (Required)
	Package keep-in area of component (Required conditionally)
	Surrounding package keep-out area of component (Required conditionally)
	Surrounding route keep-in area (Required conditionally)
	Surrounding route keep-out area (Required conditionally)
	Surrounding hole keep-in area (Required conditionally)
	Surrounding hole keep-out area (Required conditionally)
	Upper height limit area of component (Required conditionally)
	Flux keep-out area (Required conditionally)
	Reserved assembly space (Required conditionally)
	Recommended board edge design outline (Required conditionally)
	Recommended opening position of panel (Required conditionally)
	Stencil design (Required conditionally)
	Pad design (Required conditionally)
	Other custom design constraints (Required conditionally)

Note: For pad design, the holes/ vias should be presented.

6 MODEL SEMANTIC INFORMATION

6.1 Unit System Information This describes the information of unit system of the model (e.g., mm-kg-s, m-kg-s, mm-g-s). Metric units are preferred.

6.2 Dimension and Tolerance Information The dimension and tolerance information should be presented in the semantic information and should be referred to component geometry. See Table 6-1.

Table 6-1 Dimension and Tolerance Information

	Item	Necessity
Dimension And Tolerance Information	Component length and tolerance	Required
	Component width and tolerance	Required
	Component height and tolerance	Required
	Component lead coplanarity	Required conditionally, should be presented for surface mounting devices
	Component lead true position	Required
	Component standoff	Required

6.3 Material Information The material information refers to component geometry. The name of materials **shall** be included, and the material physical parameters (e.g., density, elasticity modulus, Poisson's ratio) are optional. See Table 6-2.

The cells in the Table 6-2 **shall** be filled in by MBD model providers according to the actual condition.

Table 6-2 Material Information

Material Name (Required)	Material Parameters (optional)					
	Density	Elasticity Modulus	Stress-Strain Curve	Poisson's Ratio	CTE	Others

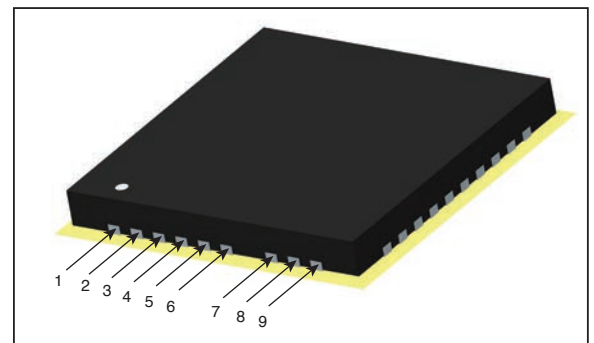
6.4 Geometric Label Information Geometric label information is associated with component geometry, used for identifying model geometry with special meaning.

6.4.1 PIN Number Label The identification of component lead number **shall** be identified. See Figure 6-1.

For land grid array or ball grid array components, the pin number label numbering convection **shall** follow JDEC SPP-010.

For gull-wing type component, the pin number label numbering convection **shall** follow JDEC SPP-012.

For the other type component, the pin number label numbering convection should be decided AABUS.

**Figure 6-1 Schematic Diagram of Pin Number Label**

6.4.2 Deformable Part Label This is used to identify the deformable parts of the component. Any deformable parts **shall** be identified. See Figure 6-2.

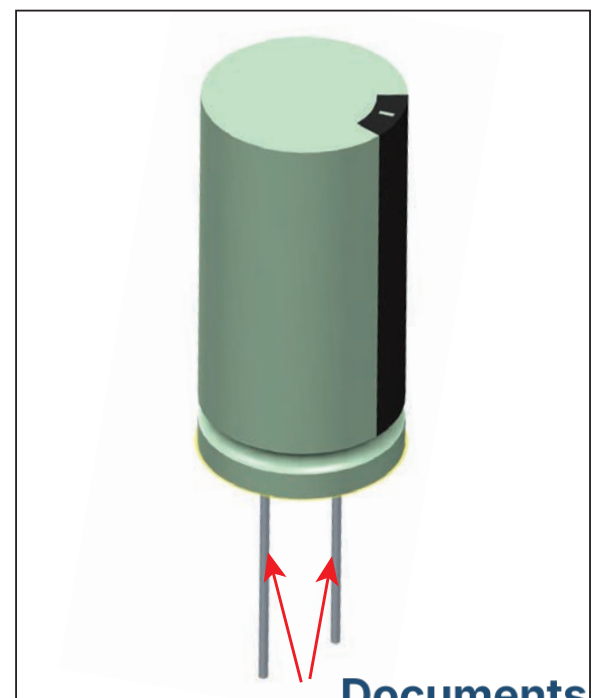
6.4.3 Component Polarity Identification This is used to identify the polarity of the component. Components with polarities **shall** be identified. See Figure 6-3.

6.4.4 Component Orientation Identifier The orientation identifier is used to identify the directions of the component. See Figure 6-4.

6.4.5 Component Mounting Positioning Label This is used to mark and identify the positioning mounting surface of the component in assembly. See Figure 6-5.

6.4.6 Part and Module Label This is used to identify the more subdivided parts of the body and lead (e.g., die, substrate, underfill, adhesive in the body structure, as shown in Figure 6-6).

6.4.7 Design Constraint Geometry Label This is used to mark and identify the design constraint geometry in the component (e.g., the recommended opening position of the panel as shown in Figure 6-7). Various keep-out areas or printed board design restricted areas related to the component also fall into the scope of design constraint geometry.

**Figure 6-2 Schematic Diagram of Deformable Part Label**

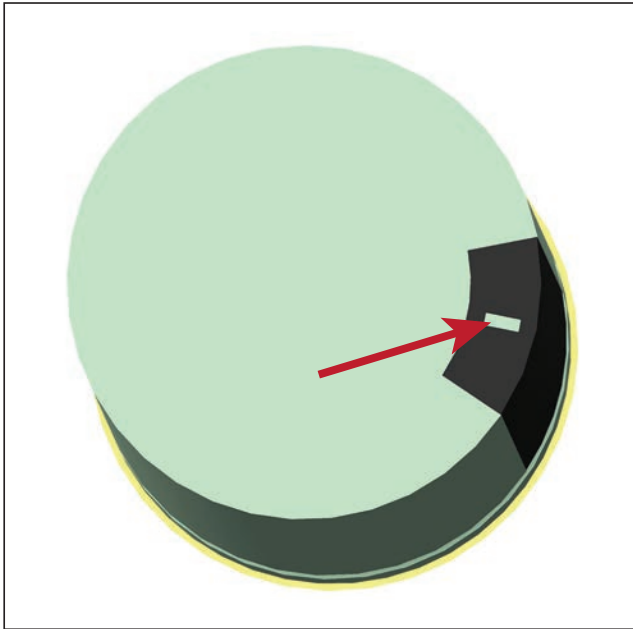


Figure 6-3 Schematic Diagram of Component Polarity Identification

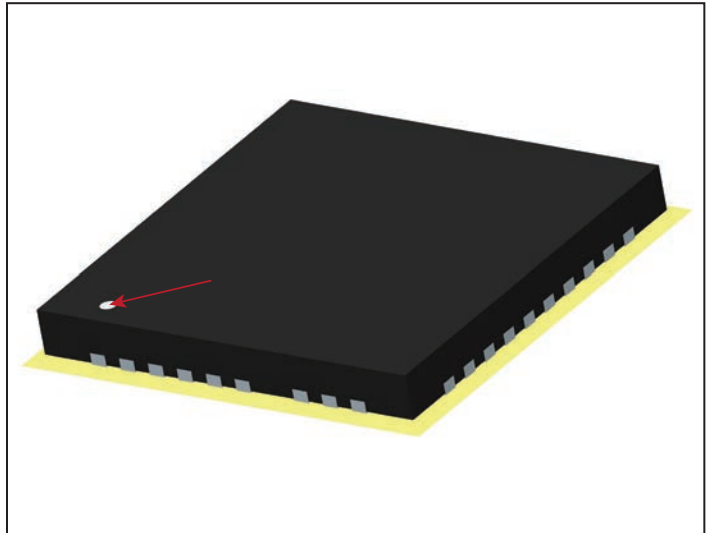


Figure 6-4 Schematic Diagram of Component Orientation Identifier

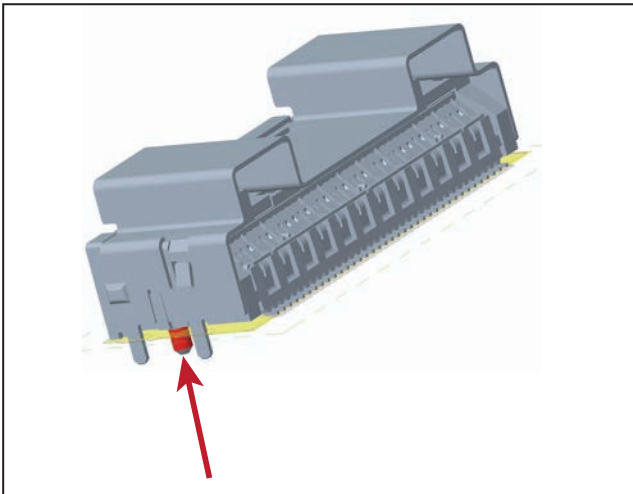


Figure 6-5 Schematic Diagram of Component Mounting Positioning Label

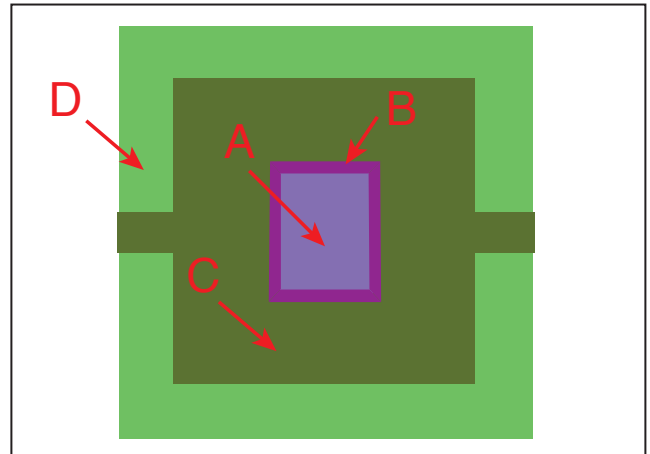


Figure 6-6 Schematic Diagram of Part and Module Label

A – Body_Die
B – Body_Underfill
C – Body_Substrate
D – Body_Adhesive

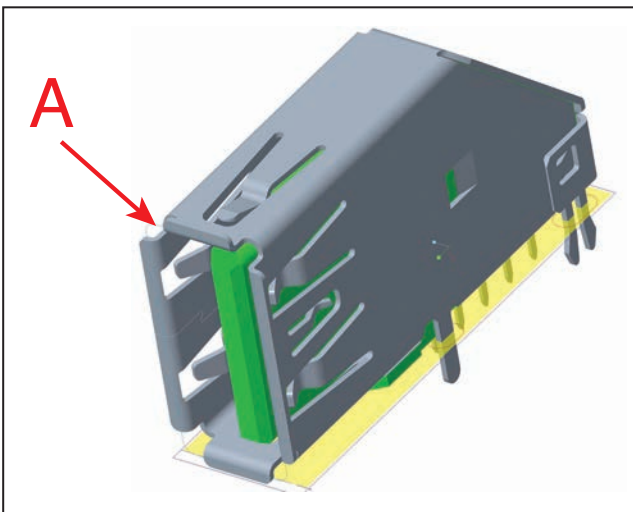


Figure 6-7 Schematic Diagram of Design Constraint Geometry Label

A – Recommended opening position of the panel

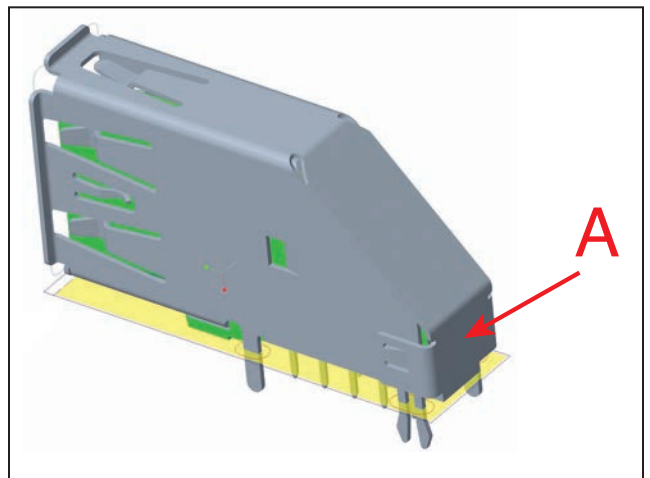


Figure 6-8 Schematic Diagram of Body Shape Conductive Area Label

A – Electrical conductive surface

6.4.8 Body Conductive Area Label This is used to mark and identify the surface with electrical conductivity on the body shape of the component. See Figure 6-8.

6.4.9 Other Geometry Label Labels other than described in 6.4.1 through 6.4.8 can be list under this section.

These geometric labels **shall** point to a certain part(s) in the geometry model.

6.5 Weight Information Weight information includes calculated weight and nominal weight. The calculated weight is associated with geometry and material information. The nominal weight has nothing to do with geometry.

6.6 Packaging Information This section lists the packaging name and type, see Table 6-3. Part of the contents are quoted from JEDEC JESD 77 and JESD30.

Table 6-3 Packaging Types

Package Type	Symbol	Main Packaging Name/Function Components
Chip Component	R	Chip RC, including full terminal, half terminal, chip capacitor network, chip resistor network, three-terminal filter capacitor, etc.
BGA	B	Including PBGA, CGA, FCBGA, BGA connectors, etc.
Gull Wing Lead	G	Including SOT, SOP, and QFP part of RF components (e.g., circulator, power module), etc., screening box, spiral coil
J-Type Lead	J	Including part of J-type ICs and J-type inductors
Inverted J-Type	J1	Including part of J-type ICs and J-type inductors
I-Type Lead	I	Including ceramic dielectric filter, etc.
L-Type Lead	L	Including common mode inductors
L-Type (Inward)	L1	Including common mode inductors
Flat Lead	F	The lead extends straight out of the body, and the protruding part is formed without bending, including butterfly optical components, some SOTs, some RF components (e.g., RF high-power load resistor and RF fixed attenuator, power tube), diodes
Through-Hole Lead Type	T	Including various kinds of THT components
Press-Fit Lead	PF	Including various kinds of press-fit components, mainly press-fit connectors
No Lead	N	The lead is at the bottom of the body, and the standoff embedded in the body is $\leq 0.1\text{mm}$, including QFN, LGA, BCC, part of MOSFET, and castle components
Screw Type	Y	Including some connectors
Hybrid Lead 1: No Lead + Gull Wing Lead	NG	Including some MOS transistors
Hybrid Lead 2: No Lead + I-Type Lead	NI	Including ceramic dielectric filter
Hybrid Lead 3: No Lead + Through-Hole Lead	NT	Including RF coaxial connector, etc.

6.7 Process Requirement Information The cells in the Value column **shall** be full-filled in by MBD model providers.

The description column is blank in the table means that no further description necessary.

6.7.1 Assembly Mode This includes SMT, THT, press-fit and assembly. Component assembly type includes SMT, THR, wave soldering, press-fit, Hotbar, iron soldering and screw assembly (refer to IPC/JEDEC J-STD-001, IPC-A-610). The process-related semantic information is defined in this section.

6.7.2 SMT Process Requirements The semantic information required by SMT process is as shown in Table 6-4.

Table 6-4 SMT Process Requirements

Model Semantic Information	Subclass	Parameter Name	Value	Description
Process Information Requirements	SMT soldering requirements	Warpage	TBP	no further description necessary
		Soldering times	TBP	The maximum allowable soldering times
		Whether Heat resistance complies with J-STD-020 standard	TBP	no further description necessary
		Maximum allowable temperature of SMT	TBP	no further description necessary
		Allowable duration of SMT	TBP	no further description necessary
		Melt point (liquidus)	TBP	no further description necessary
		Time above liquidus	TBP	no further description necessary
Process Information Requirements	Manual soldering requirements	Maximum allowable temperature of manual soldering	TBP	Maximum set temperature for solder tip
		Allowable duration of manual soldering	TBP	no further description necessary
	Adsorption capacity of SMT	Adsorbable area $\leq 0.1\text{mm}$	TBP	no further description necessary
		Adsorbable area	TBP	Adsorbable effective area of suction nozzle Length (mm) and width (mm)
		Adsorption pressure-bearing threshold	TBP	Patch pressure that the center of SMD can withstand
	/	Whether solderability test passed	TBP	no further description necessary
	/	Whether tin whisker test passed	TBP	no further description necessary
	/	Whether fusibility test passed	TBP	no further description necessary

Note 1: “/” in the table means that no subclass.

Note 2: TBP – Value to be provided by MBD model providers.

6.7.3 THT Process Requirements The semantic information required by THT process is as shown in Table 6-5.

Table 6-5 THT Process Requirements

Model Semantic Information	Subclass	Parameter Name	Value	Description
Process Information Requirements	Packaging size	Lead spacing and tolerance	TBP	no further description necessary
		Component standoff	TBP	no further description necessary
		Lead length and tolerance	TBP	no further description necessary
		Lead diameter and tolerance	TBP	no further description necessary
	Manual soldering requirements	Maximum allowable temperature of Iron soldering	TBP	Maximum set temperature for solder tip
		Allowable duration of manual soldering	TBP	no further description necessary
	Temperature resistance	Temperature resistance of lead complies with 265 °C – 10s.	TBP	no further description necessary
		Temperature resistance of body meets 160 °C – 30s.	TBP	no further description necessary
		Maximum soldering times.	TBP	no further description necessary
	Solderability	Whether solderability test passed	TBP	no further description necessary
		Whether fusibility test passed	TBP	no further description necessary

Note: TBP – Value to be provided by MBD model providers.

6.7.4 Hotbar Process Requirements The semantic information required by Hotbar process are as shown in Table 6-6.

Table 6-6 Hotbar Process Requirements

Model Semantic Information	Subclass	Parameter Name	Value	Description
Process Information Requirements	Heat resistance	Heat resistance meets 288 °C +/-5 °C, 10 +1/-0 s	TBP	no further description necessary
		Soldering times	TBP	no further description necessary
	Flexible printed board bending resistance	FPC bending radius	TBP	no further description necessary
		FPC bending times	TBP	no further description necessary
	Solderability	Whether solderability test passed	TBP	no further description necessary

Note: TBP – Value to be provided by MBD model providers.

6.7.5 Press-Fit Process Requirements The semantic information required by press-fit process are as shown in Table 6-7.

Table 6-7 Press-Fit Process Requirements

Model Semantic Information	Subclass	Parameter Name	Value	Description
Process Information Requirements	Press-Fit process requirement	Overall press-in force of press-fit component printed board	TBP	no further description necessary
		Overall retention force of press-fit component printed board	TBP	no further description necessary
		True positive of press-fit component lead -Horizontal direction	TBP	no further description necessary
		True positive of press-fit component lead – Vertical direction	TBP	no further description necessary
		True positive of press-fit component lead – Applied to printed board thickness	TBP	no further description necessary
		True positive of press-fit component lead – Back drilling remaining thickness	TBP	no further description necessary
	Connector interchangeable relationship	Overall male and female insertion force	TBP	no further description necessary
		Overall male and female pull-out force	TBP	no further description necessary
		Contact force	TBP	no further description necessary
		Guiding capability	TBP	no further description necessary
		Guiding angle	TBP	no further description necessary
		Contact depth	TBP	no further description necessary

Note: TBP – Value to be provided by MBD model providers.

6.7.6 Screw Installation Process Requirements The semantic information required by screw installation process are as shown in Table 6-8.

Table 6-8 Screw Installation Process Requirements

Model Semantic Information	Subclass	Parameter Name	Value	Description
Process Information Requirements	Screw installation process requirements	Screw torque	TBP	no further description necessary
	Screw installation process requirements	Contact area	TBP	no further description necessary

Note: TBP – Value to be provided by MBD model providers.

6.8 Risk Sensitivity Information Risk sensitivity information such as temperature sensitivity, moisture sensitivity, stress sensitivity are listed in Table 6-9.

Table 6-9 Risk Sensitivity Information

Model Semantic Information	Level 1 subclass	Level 2 subclass	Parameter Name	Value	Description
Process Information Requirements	Process sensitivity	/	PSL	TBP	Refer to IPC/JEDEC J-STD-075 for more details
Process Information Requirements	Moisture sensitivity	/	MSL	TBP	1
					2
					2a
					3
					4
					5
					5a
					6
	Stress sensitivity	Compression	Transient compressive static stress	TBP	no further description necessary
			Long-Term compressive static stress	TBP	no further description necessary
		Tension		TBP	no further description necessary
		Shear		TBP	no further description necessary
		Bending		TBP	no further description necessary
		Torsion		TBP	no further description necessary
	Chemical compatibility	Cleaning	Cleanable or not	TBP	no further description necessary
		/	Recommended cleaning condition	TBP	no further description necessary
		/	Rejected cleaning condition	TBP	no further description necessary
		Coating	Can be coat or not	TBP	Conformal coating, used for EMC shielding or environment shielding (moisture proof, fungus proof)