

# **JEDEC PUBLICATION**

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## **PartModel Design Rule Kits Guidelines for Electronic-Device Packages – XML Requirements**

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**JEP30-K100**

February 2025

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**JEDEC SOLID STATE TECHNOLOGY ASSOCIATION**



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## PartModel Design Rule Kits Guidelines for Electronic-Device Packages – XML Requirements

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## **PART MODEL SUPPLYCHAIN GUIDELINE FOR ELECTRONIC-DEVICE PACKAGES - XML REQUIREMENTS**

(From JEDEC Board Ballots JCB-24-53, formulated under the cognizance of the JC-11 Committee on Mechanical Standardization.)

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### **1 Scope**

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The JEP30 document establishes the requirements for exchanging part data between part manufacturers and their customers for electrical and electronic products. The JEP30 documents are part of a series to describe XML data exchange structure and hierarchy. The JEP30 document series will detail data exchange between companies for design at the next level, analysis, and interconnection. The parent JEP30 document specifically focuses on the parental structure, under which several sub-sections are listed, such as electrical, physical, thermal, supply chain, assembly process classification, generated ECAD models, and environment including material declaration. This document adds a new section called the Design Kit sub-section to the JEP30 PartModel XML Schema series.

#### **1.1 Purpose**

This standard is intended to benefit part manufacturers and their customers by providing consistency and efficiency to the transfer of part design rule data from part manufacturer to customers. It establishes standard electronic data exchange formats that will facilitate and improve data transfer along the entire global supply chain, at every stage in the product life cycle. A key aspect therefore is the structure of the content that is contained in this format, which the committee believes should be based on the following two principals:

- 1) Data that is required to be consumed by software tools, and
- 2) Data that is not required to be consumed by software tools but is provided for informational purpose.

This standard specifically covers data applicable to the Design Rule Kits that is required to support the design, fabrication and consumption modelling of the device.

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## 2 Applicable Documents

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### 2.1 JEDEC ([www.jedec.org](http://www.jedec.org))

**JEP30**, *PartModel Guidelines for Electronic-Device Packages – XML Requirements*

**JEP30-A100**, PartModel Assembly Process Classification Guidelines for Electronic-Device Packages – XML Requirements

**JEP30-E100**, *PartModel Electrical Guidelines for Electronic-Device Packages – XML Requirements*

**JEP30-P100**, PartModel Package Guidelines for Electronic-Device Packages – XML Requirements

**JEP30-T100**, PartModel Thermal Guidelines for Electronic-Device Packages – XML Requirements

#### 2.1.1 JEDEC PartModel Schema and Sub-Schemas

**JEP30-10**, PartModel Schema

**JEP30-A101**, PartModel Assembly Process Classification Schema

**JEP30-E101**, PartModel Electrical Schema

**JEP30-P101**, PartModel Package Schema

**JEP30-S101**, PartModel Supply Chain Schema

**JEP30-T101**, PartModel Thermal Schema

**JEP30-K101**, PartModel Design Kit Schema

**JEP30-M101**, PartModel Generated ECAD – Models Schema

**JEP30-D10**, *PartModel Schema Types Dictionary* (Required to support the PartModel Schema and each of its sectional sub-schemas.)

### 2.2 IPC ([www.ipc.org](http://www.ipc.org))

**IPC-7352**, Generic Guideline for Land Pattern Design

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## 3 Requirements

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The following terms and definitions are applicable to this XML Schema.

### 3.1 Terms and Definitions

All definitions and terms associated with the Design Kit Data are defined in the relevant standards that govern the definition of those parameters, as listed in the applicable documents section. The Design Kit details of the part are defined in the [DesignKitSection](#) of the XML Schema.

All common Terms and Definitions that are used by more than one sectional sub-schema, such as any of the Assembly Process Classification, Electrical, Environmental, Package, Supply Chain, Thermal, Design Kits, or Generated ECAD Models are defined in the “JEP30-D10 PartModel Schema Types Library”.

All other definitions and terms necessary to define the schema, are defined by this document.

**PartModel:** A PartModel is a data representation described in an XML file that conforms to the rules and structure of the PartModel XML Schema.

NOTE 1 Companies who use the PartModel XML Files and claim compliance to JEDEC, must ensure that their PartModel XML file conforms to the specific released version of the PartModel XML Schema released by JEDEC.

NOTE 2 Section 4 will define the outline of the structure of the Design Kit XML Schema. Specific components of the XML Schema and their hierarchy are specifically controlled by the JC-11 Standards Committee who retain the expertise for these structures.

NOTE 3 The [DesignKitSection](#) of the schema forms part of the PartModel XML Schema and is not intended to act as a standalone schema. In addition, there is a “PartModel Schema Types Library” XML Schema, which is a common set of xml structures shared across the PartModel XML Schema and all of its sub-section schemas.

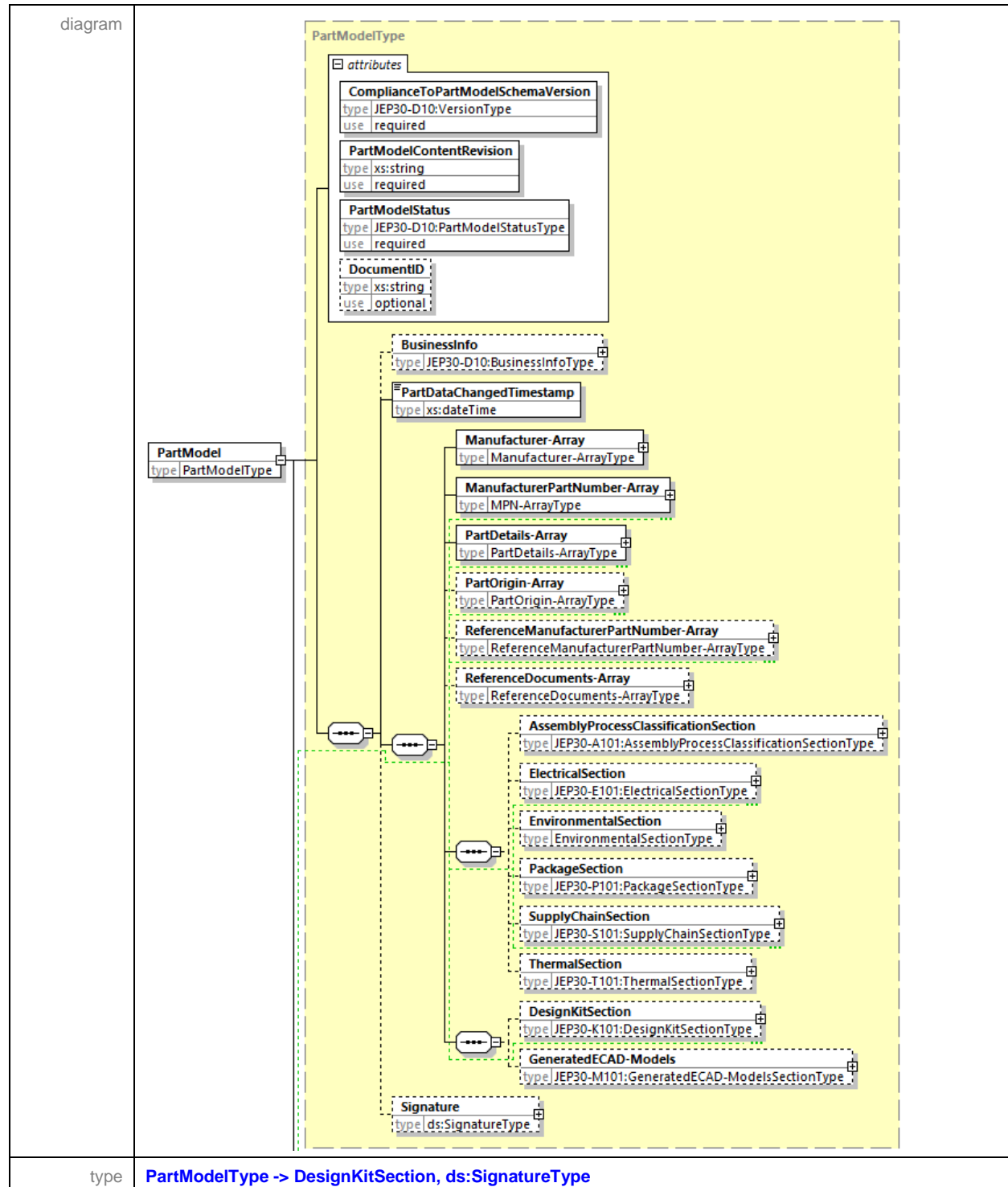
### 3.2 XML Schema Key Terms and Definitions

Reference the JEP30 publication for details of the “XML Schema Key Terms and Definitions”.

## 4 PartModel Schema Definition

The following section describes the XML Schema structure.

### 4.1 PartModel – Design Kit Section



#### 4.1 PartModel – Design Kit Section (cont'd)

The [PartModelType](#) belongs to the “PartModel XML Schema”. The [DesignKitSection](#) belongs to the “PartModel Design Kit XML Schema”. The primary purpose of the PartModel Schema is to provide the structure for identifying unique parts (Manufacturer and MPN), and the structure to include the sub schemas which define the part details, as outline in the JEP30 - PartModel Guidelines for Electronic-Device Packages – XML Requirements.

This document covers the [DesignKitSection](#), which is referenced from its parent’s structure, the [PartModel](#). The contents under the [DesignKitSection](#) are

1. Tied to the Manufacturer’s name and Manufacturer’s part number if the Design kit is applicable to a part or a chiplet, or
2. Tied to the Manufacturer’s name and Process Technology Identifier if the Design kit is applicable to a process technology as in the design rules applicable to an organic Interposer, or .
3. Tied to a Standards Body and a Standards Identifier, if the Design Kit represents a standard set of rules as defined by a specific Standards Body.

All releases of the [DesignKitSection](#) sub-schema must be under the umbrella of the PartModel Schema to ensure that the PartModel schema is referencing the correct version of the Design Kit sub-schema. In addition, this will enable the Design Kit sub-schemas to connect to the identity structure as defined in the parent schema JEP30.

The [ComplianceToPartModelSchemaVersion](#) indicates the version of the Schema to which the XML file is to be validated against. All new releases to this document or XML Schema is governed by the rules outlined in JEP30, and must be released in sync with the PartModel.

“Each time that a Sub-schema gets updated, then the PartModel version also gets updated in order to release that Sub-schema under the umbrella of the PartModel. This is because the PartModel must now reference the new version of Sub-schema, since all subschemas have their own version number. The parent schema includes them by referring to a precise version, so a version bump in the subschema requires a version bump in the parent only at the time of release of the Parent.”

The [PartModelContentRevision](#) indicates the revision of the data for the Part that is submitted in the XML file. This enables the Component Manufacturer to provide a new XML file for a Part each time they wish to upgrade a new set of data for a part, in any of the sub-sections such as this [DesignKitSection](#).

## 4.2 Manufacturer Part Number-Array

path	<a href="#">PartModel/ManufacturerPartNumber-Array.</a>
diagram	<p>The diagram illustrates the XML Schema Definition (XSD) for the <b>ManufacturerPartNumber-Array</b>. It is composed of two main parts: <b>MPN-ArrayType</b> and <b>ManufacturerPartNumbersType</b>.</p> <ul style="list-style-type: none"> <li><b>MPN-ArrayType</b> contains a <b>ManufacturerPartNumbers</b> element (type <b>ManufacturerPartNumbersType</b>) with a cardinality of 1..∞.</li> <li><b>ManufacturerPartNumbersType</b> contains several optional elements (cardinality 0..∞): <ul style="list-style-type: none"> <li><b>ID</b> (type <b>xs:string</b>)</li> <li><b>PartNumberSeries</b> (type <b>PartNumberType</b>)</li> <li><b>OrderablePartNumber</b> (type <b>OrderablePartNumberType</b>)</li> <li><b>FuturePart</b> (type <b>FuturePartType</b>)</li> <li><b>StandardsIdentifier</b> (type <b>StandardsIdentifierType</b>)</li> <li><b>ProcessTechnologyIdentifier</b> (type <b>ProcessTechnologyIdentifierType</b>)</li> <li><b>ManufacturerID</b> (type <b>xs:string</b>)</li> <li><b>ManufacturerSignatureDigest</b> (type <b>JEP30-D10:SignatureDigestLinkType</b>)</li> <li><b>ManufacturerPartNumbersIdentitySignature</b> (type <b>ds:SignatureType</b>)</li> </ul> </li> </ul> <p>A <b>constraints</b> tab is visible at the bottom left of the diagram area.</p>
type	<a href="#">MPN-ArrayType</a> , <a href="#">ManufacturerPartNumbersType</a> , <a href="#">PartNumberType</a> , <a href="#">OrderablePartNumberType</a> , <a href="#">FuturePartType</a> , <a href="#">StandardsIdentifierType</a> , <a href="#">ProcessTechnologyIdentifierType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a> , <a href="#">ds:SignatureType</a> .

The [ManufacturerPartNumber-Array/ManufacturerPartNumbers](#) provides the definition of the part number, design kit, or a specific Standard, so that it can be connected to the technical specification details in the [DesignKitSection](#) via the [PartDetails-Array](#) section.

## 4.3 Linking the Manufacturing Part Number to a specific Design Kit Data set

The linking of the Parts, Standards or Process Technology Identifier to its technical data is done via the [PartDetails-Array](#) section as outline in the JEP30 - PartModel Guidelines for Electronic-Device Packages – XML Requirements. This consists of two sections called [PartsSelection-Array](#) and [Association-Array](#) which defines the relationship between identifying the specific set of parts, process identifiers, or standards identifiers and how they are associated with the Design Kit content. Reference the JEP30 parent document for more details on this association.

#### 4.3 Linking the Manufacturing Part Number to a specific Design Kit Data set (cont'd)

path	<b>PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array</b>	
diagram at the Association level		
type	<b>DesignKitAssociation-ArrayType, PackageAssemblyDesignKitAssociationType, PackageSubstrateDesignKitAssociationType, MaterialDesignKitAssociationType, PackageTestDesignKitAssociationType, FootprintRuleDesignKitAssociationType, SymbolRuleDesignKitAssociationType.</b>	
path	<b>PartModel/DesignKitSection</b>	
diagram at the Design Kit Section level		
type	<b>JEP30-K101:DesignKitSectionType, JEP30-D10:AssemblyTechnology-ArrayType, PackageAssemblyDesignKit-ArrayType, PackageSubstrateDesignKit-ArrayType, MaterialDesignKit-ArrayType, PackageTestDesignKit-ArrayType, FootprintRuleDesignKit-ArrayType, SymbolRuleDesignKit-ArrayType.</b>	

#### 4.3.1 Linking the Manufacturing Part Number to Package Assembly Design Kit

path	<a href="#">PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array/PackageAssemblyDesignKit</a>
diagram at the Package Assembly Design Kit Association level	
type	<a href="#">PackageAssemblyDesignKitAssociationType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a>
path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array</a>
diagram at the Package Assembly Design Kit level.	
type	<a href="#">PackageAssemblyDesignKit-ArrayType</a> , <a href="#">AssemblyDesignKitType</a> , <a href="#">DesignClassification-ArrayType</a> , <a href="#">RuleCondition-ArrayType</a> , <a href="#">AssemblyType</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a> .

The [PackageAssemblyDesignKitID](#) references the [PackageAssemblyDesignKit/ID](#) under the [DesignKitSection/PackageAssemblyDesignKit-Array](#). This is enforced by the key named as [PackageAssemblyDesignKitKey](#) that is assigned to the [PackageAssemblyDesignKit/ID](#) element, which is referenced by the [PackageAssemblyDesignKitID](#) which has a KeyRef that refers to the [JEP30-K101:PackageAssemblyDesignKitKey](#).



#### 4.3.2 Linking the Manufacturing Part Number to Package Substrate Design Kit

path	<a href="#">PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array/PackageSubstrateDesignKit</a>
diagram at the Package Substrate Design Kit Association level	
type	<a href="#">PackageSubstrateDesignKitAssociationType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a>
path	<a href="#">PartModel/DesignKitSection/PackageSubstrateDesignKit-Array</a>
diagram at the Package Substrate Design Kit level.	
type	<a href="#">PackageSubstrateDesignKit-ArrayType</a> , <a href="#">PackageSubstrateDesignKitType</a> , <a href="#">DesignClassification-ArrayType</a> , <a href="#">RuleCondition-ArrayType</a> , <a href="#">FabricationType</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a> .

The [PackageSubstrateDesignKitID](#) references the [PackageSubstrateDesignKit/ID](#) under the DesignKitSection/PackageSubstrateDesignKit-Array. This is enforced by the key named as [PackageSubstrateDesignKitKey](#) that is assigned to the [PackageSubstrateDesignKit/ID](#) element, which is referenced by the [PackageSubstrateDesignKitID](#) which has a KeyRef that refers to the [JEP30-K101:PackageSubstrateDesignKitKey](#).

### 4.3.3 Linking the Manufacturing Part Number to Material Design Kit

path	<a href="#">PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array/MaterialDesignKit</a>
diagram at the Material Design Kit Association level	
type	<a href="#">MaterialDesignKitAssociationType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a>
path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array</a>
diagram at the Material Design Kit level.	
type	<a href="#">MaterialDesignKit-ArrayType</a> , <a href="#">MDK-Material-ArrayType</a> , <a href="#">MDK-MaterialClassification-ArrayType</a> , <a href="#">MaterialDesignKit</a> , <a href="#">MDK-ElectricalPropertiesType</a> , <a href="#">MDK-ThermalPropertiesType</a> , <a href="#">MDK-StructuralPropertiesType</a> , <a href="#">MDK-OpticalPropertiesType</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a> .

The [MaterialDesignKitID](#) references the [MaterialDesignKit/ID](#) under the [DesignKitSection/MaterialDesignKit-Array](#). This is enforced by the key named as [MaterialDesignKitKey](#) that is assigned to the [MaterialDesignKit/ID](#) element, which is referenced by the [MaterialDesignKitID](#) which has a KeyRef that refers to the [JEP30-K101:MaterialDesignKitKey](#).

#### 4.3.4 Linking the Manufacturing Part Number to Package Test Design Kit

path	<a href="#">PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array/PackageTestDesignKit</a>
diagram at the Package Test Design Kit Association level	
type	<a href="#">PackageTestDesignKitAssociationType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a>
path	<a href="#">PartModel/DesignKitSection/PackageTestDesignKit-Array</a>
diagram at the Package Test Design Kit level.	
type	<a href="#">PackageTestDesignKit-ArrayType</a> , <a href="#">PackageTestDesignKit</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a> .

The [PackageTestDesignKitID](#) references the [PackageTestDesignKit/ID](#) under the DesignKitSection/PackageTestDesignKit-Array. This is enforced by the key named as [PackageTestDesignKitKey](#) that is assigned to the [PackageTestDesignKit/ID](#) element, which is referenced by the [PackageTestDesignKitID](#) which has a KeyRef that refers to the [JEP30-K101:PackageTestDesignKitKey](#).

#### 4.3.5 Linking the Manufacturing Part Number to Footprint Rule Design Kit

path	<a href="#">PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array/FootprintRuleDesignKit</a>
diagram at the Footprint Rule Design Kit Association level	<p>The diagram shows a dashed box labeled <b>FootprintRuleDesignKitAssociationType</b>. Inside, there is a dashed box for <b>FootprintRuleDesignKit</b> with type <code>FootprintRuleDesignKitAssociationType</code> and a multiplicity of <code>0..∞</code>. This is connected to another dashed box containing <b>FootprintRuleDesignKitID</b> (type <code>xs:string</code>) and <b>FootprintRuleDesignKitSignature</b> (type <code>JEP30-D10:SignatureDigestLinkType</code>). A red arrow points from a red circle labeled 'E' to the <b>FootprintRuleDesignKitID</b> element.</p>
type	<a href="#">FootprintRuleDesignKitAssociationType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a>
path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array</a>
diagram at the Footprint Rule Design Kit level.	<p>The diagram shows a dashed box labeled <b>FootprintRuleDesignKit-ArrayType</b>. Inside, there is a dashed box for <b>FootprintRuleDesignKit-Array</b> with type <code>FootprintRuleDesignKit-ArrayType</code> and a multiplicity of <code>1..∞</code>. This is connected to a dashed box for <b>FootprintRuleDesignKit</b> (type <code>FootprintRuleDesignKitType</code>). Inside this box, there is a dashed box for <b>Footnote-Array</b> (type <code>JEP30-D10:Footnote-ArrayType</code>) and <b>FootprintRuleDesignKitSignature</b> (type <code>ds:SignatureType</code>). A red arrow points from a red circle labeled 'R' to the <b>ID</b> element (type <code>xs:string</code>) within the <b>Footnote-Array</b> box.</p>
type	<a href="#">FootprintRuleDesignKit-ArrayType</a> , <a href="#">FootprintRuleDesignKit</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a> .

The [FootprintRuleDesignKitID](#) references the [FootprintRuleDesignKit/ID](#) under the [DesignKitSection/FootprintRuleDesignKit-Array](#). This is enforced by the key named as [FootprintRuleDesignKitKey](#) that is assigned to the [FootprintRuleDesignKit/ID](#) element, which is referenced by the [FootprintRuleDesignKitID](#) which has a KeyRef that refers to the [JEP30-K101:FootprintRuleDesignKitKey](#).

#### 4.3.6 Linking the Manufacturing Part Number to Symbol Rule Design Kit

path	<a href="#">PartModel/PartDetails-Array/PartDetails/Association-Array/Association/DesignKit-Array/SymbolRuleDesignKit</a>
diagram at the Symbol Rule Design Kit Association level	
type	<a href="#">SymbolRuleDesignKitAssociationType</a> , <a href="#">JEP30-D10:SignatureDigestLinkType</a>
path	<a href="#">PartModel/DesignKitSection/SymbolRuleDesignKit-Array</a>
diagram at the Symbol Rule Design Kit level.	
type	<a href="#">SymbolRuleDesignKit-ArrayType</a> , <a href="#">SymbolRuleDesignKit</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a> .

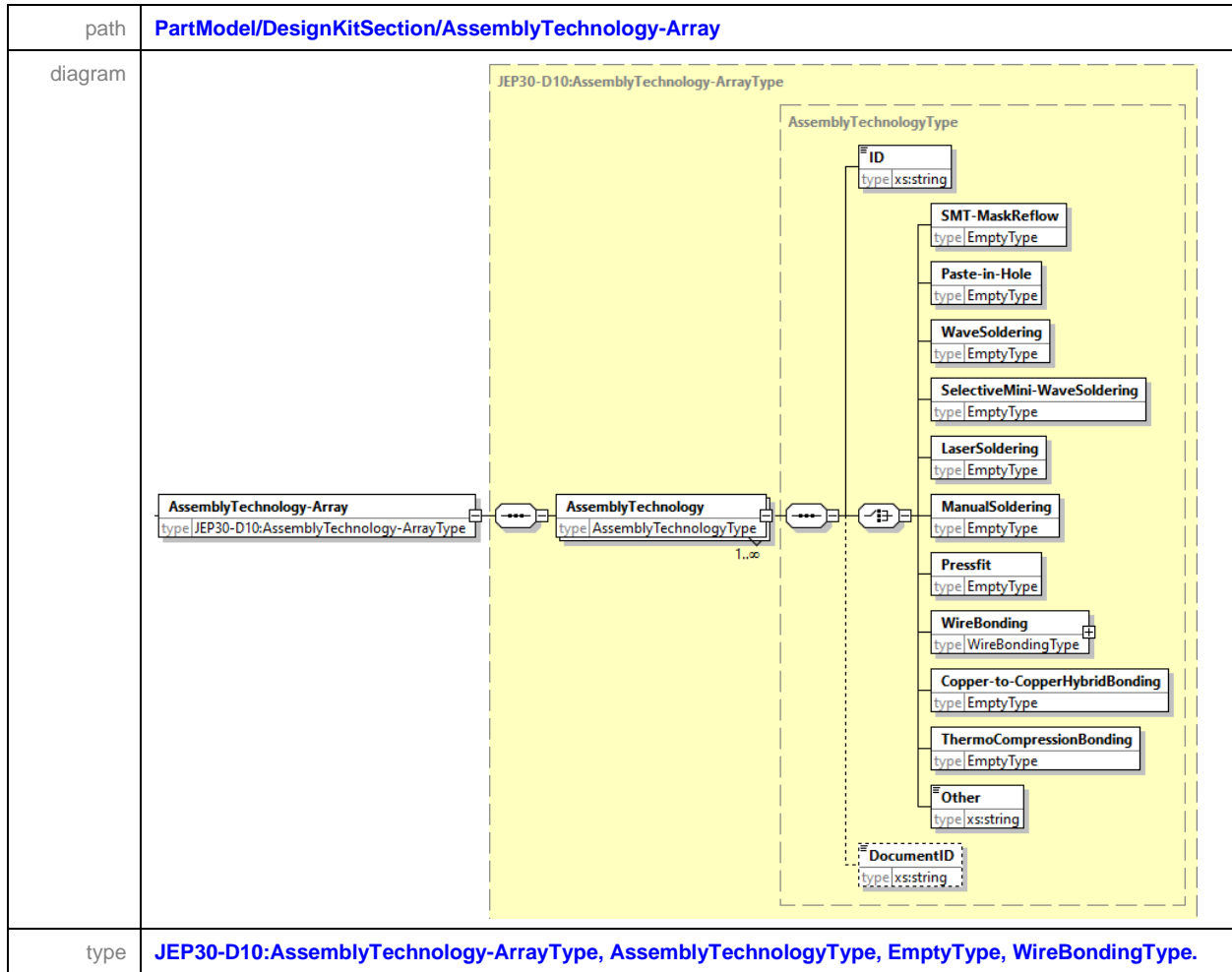
The [SymbolRuleDesignKitID](#) references the [SymbolRuleDesignKit/ID](#) under the DesignKitSection/SymbolRuleDesignKit-Array. This is enforced by the key named as [SymbolRuleDesignKitKey](#) that is assigned to the [SymbolRuleDesignKit/ID](#) element, which is referenced by the [SymbolRuleDesignKitID](#) which has a KeyRef that refers to the [JEP30-K101:SymbolRuleDesignKitKey](#).

## 5 Design Kit Section

path	<b>PartModel/DesignKitSection</b>
diagram	<pre> classDiagram     class DesignKitSection {         type JEP30-K101:DesignKitSectionType     }     class AssemblyTechnologyArray {         type JEP30-D10:AssemblyTechnology-ArrayType     }     class PackageAssemblyDesignKitArray {         type PackageAssemblyDesignKit-ArrayType     }     class PackageSubstrateDesignKitArray {         type PackageSubstrateDesignKit-ArrayType     }     class MaterialDesignKitArray {         type MaterialDesignKit-ArrayType     }     class PackageTestDesignKitArray {         type PackageTestDesignKit-ArrayType     }     class FootprintRuleDesignKitArray {         type FootprintRuleDesignKit-ArrayType     }     class SymbolRuleDesignKitArray {         type SymbolRuleDesignKit-ArrayType     }     DesignKitSection "1" -- "*" AssemblyTechnologyArray     DesignKitSection "1" -- "*" PackageAssemblyDesignKitArray     DesignKitSection "1" -- "*" PackageSubstrateDesignKitArray     DesignKitSection "1" -- "*" MaterialDesignKitArray     DesignKitSection "1" -- "*" PackageTestDesignKitArray     DesignKitSection "1" -- "*" FootprintRuleDesignKitArray     DesignKitSection "1" -- "*" SymbolRuleDesignKitArray     </pre>
type	<b>JEP30-K101:DesignKitSectionType, JEP30-D10:AssemblyTechnology-ArrayType, PackageAssemblyDesignKit-ArrayType, PackageSubstrateDesignKit-ArrayType, MaterialDesignKit-ArrayType, PackageTestDesignKit-ArrayType, FootprintRuleDesignKit-ArrayType, SymbolRuleDesignKit-ArrayType.</b>

The [DesignKitSection](#) consists of 7 sections as shown above in the diagram. Each of these sections are described in further detail in the sub-sections below.

## 5.1 Assembly Technology - Array



The [AssemblyTechnology-Array](#) outlines the various technologies that can be applied to the part during its assembly to its parent's assembly. This technology can drive the rules values for the design kits that are defined in this [DesignKitSection](#).

## 5.2 Package Assembly Design Kit - Array

path	<b>PartModel/DesignKitSection/PackageAssemblyDesignKit-Array</b>
diagram	
type	<b>PackageAssemblyDesignKit-ArrayType, PackageAssemblyDesignKitType, DesignClassification-ArrayType, RuleCondition-ArrayType, AssemblyType, JEP30-D10:Footnote-ArrayType, ds:SignatureType</b>

### 5.2.1 Design Classification - Array

path	<b>PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/DesignClassification-Array</b>
diagram	
type	<b>DesignClassification-ArrayType, DesignClassificationType.</b>



## 5.2.2 Rule Condition - Array

path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array</a>
diagram	<pre> classDiagram     class RuleConditionArray {         type RuleCondition-ArrayType     }     class FeatureSelectionArea {         type FeatureSelectionAreaType     }     class FeatureTypeSelection {         type FeatureTypeSelectionType     }     class FeaturePlacement {         type FeaturePlacementType     }     class FeatureControl {         type FeatureControlType     }     class RuleCondition {         type RuleConditionType     }     RuleConditionArray "0..∞" -- "0..∞" FeatureSelectionArea     RuleConditionArray "0..∞" -- "0..∞" FeatureTypeSelection     RuleConditionArray "0..∞" -- "0..∞" FeaturePlacement     RuleConditionArray "0..∞" -- "0..∞" FeatureControl     RuleConditionArray "0..∞" -- "0..∞" RuleCondition     </pre> <p>The diagram illustrates the structure of the RuleCondition-Array. It is a container type (RuleCondition-ArrayType) that holds five sub-elements: FeatureSelectionArea, FeatureTypeSelection, FeaturePlacement, FeatureControl, and RuleCondition. Each sub-element is represented by a dashed box containing its name and its type (e.g., FeatureSelectionAreaType). The multiplicity for each sub-element is 0..∞, indicating that each can appear zero or more times. The container itself is represented by a solid box with the name RuleCondition-Array and its type RuleCondition-ArrayType. A multiplicity of 0..∞ is also shown for the container, indicating it can appear zero or more times.</p>
type	<a href="#">RuleCondition-ArrayType</a> , <a href="#">FeatureSelectionAreaType</a> , <a href="#">FeatureTypeSelectionType</a> , <a href="#">FeaturePlacementType</a> , <a href="#">FeatureControlType</a> , <a href="#">RuleConditionType</a> .

5.2.2.1 Feature Selection Area

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureSelectionArea
diagram	
type	FeatureSelectionAreaType, JEP30-D10:EmptyType, FeatureSelectionAreaRegionType.

### 5.2.2.1.1 Area Region

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureSelectionArea/AreaRegion
diagram	<pre> classDiagram     class AreaRegion {         type FeatureSelectionAreaRegionType     }     class ID {         type xs:string     }     class Rectangle {         type JEP30-D10:RectangleValueType     }     class ModifiedRectangle {         type JEP30-D10:ModifiedRectangleValueType     }     class ShapeCenter {         type JEP30-D10:PointXYType     }     class StartingPoint {         type JEP30-D10:PointXYType     }     class Contour {         type JEP30-D10:ContourShapeValueType     }     class JEP30_D10_RectangleValueType {         Dimension1 type ValueType         Dimension2 type ValueType         Angle type xs:integer     }     class JEP30_D10_ModifiedRectangleValueType {         Dimension1 type ValueType         Dimension2 type ValueType         Angle type xs:integer         ImpactedCorner type ImpactedCornerValueType     }     class JEP30_D10_PointXYType {         x type xs:decimal         y type xs:decimal     }     class ImpactedCornerValueType {         type ImpactedCornerValueType     }      AreaRegion -- ID     AreaRegion -- Rectangle     AreaRegion -- ModifiedRectangle     AreaRegion -- ShapeCenter     AreaRegion -- StartingPoint     AreaRegion -- Contour     Rectangle -- JEP30_D10_RectangleValueType     ModifiedRectangle -- JEP30_D10_ModifiedRectangleValueType     ShapeCenter -- JEP30_D10_PointXYType     StartingPoint -- JEP30_D10_PointXYType </pre>
type	FeatureSelectionAreaRegionType, JEP30-D10:RectangleValueType, ValueType, JEP30-D10:ModifiedRectangleValueType, ImpactedCornerValueType, JEP30-D10:PointXYType, JEP30-D10:ContourShapeValueType,

### 5.2.2.1.1.1 Impacted Corner

path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureSelectionArea/AreaRegion/ModifiedRectangle/ImpactedCorner</a>
diagram	
type	<a href="#">ImpactedCornerValueType</a> , <a href="#">CornerValueType</a> , <a href="#">ChamferedCornerValueType</a> , <a href="#">ConvexCornerValueType</a> , <a href="#">ValueType</a> .

### 5.2.2.1.1.2 Contour

path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureSelectionArea/AreaRegion/ModifiedRectangle/Contour</a>
diagram	
type	<a href="#">JEP30-D10:ContourShapeValueType</a> , <a href="#">ContourShapeOutline-ArrayType</a> , <a href="#">ContourShapeOutlineType</a> , <a href="#">ArcSegmentRotationType</a>

The enumerated values for the [ArcSegmentRotation](#) are Clockwise and Anti-clockwise.

### 5.2.2.2 Feature Type Selection

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureTypeSelection
diagram	<p>The diagram illustrates the structure of the <b>FeatureTypeSelectionType</b>. It is a sequence of elements, all of type <b>JEP30-D10:EmptyType</b>:</p> <ul style="list-style-type: none"> <li><b>ID</b> (type <b>xs:string</b>)</li> <li><b>Part</b></li> <li><b>Via</b></li> <li><b>Hole</b></li> <li><b>Trace</b></li> <li><b>NPTH</b></li> <li><b>PTH</b></li> <li><b>Fiducial</b></li> <li><b>Profile</b></li> <li><b>Pad</b></li> <li><b>AnularRing</b></li> <li><b>ToolingHole</b></li> <li><b>MountingHole</b></li> </ul> <p>A dashed box labeled <b>FeatureTypeSelection</b> encompasses the sequence of elements from <b>Part</b> to <b>MountingHole</b>, with a cardinality of <b>0..∞</b>. Another dashed box labeled <b>SizeCriteria</b> contains the element <b>SizeCriteria</b> (type <b>SizeCriteriaType</b>), also with a cardinality of <b>0..∞</b>.</p>
type	FeatureTypeSelectionType, JEP30-D10:EmptyType, SizeCriteriaType.

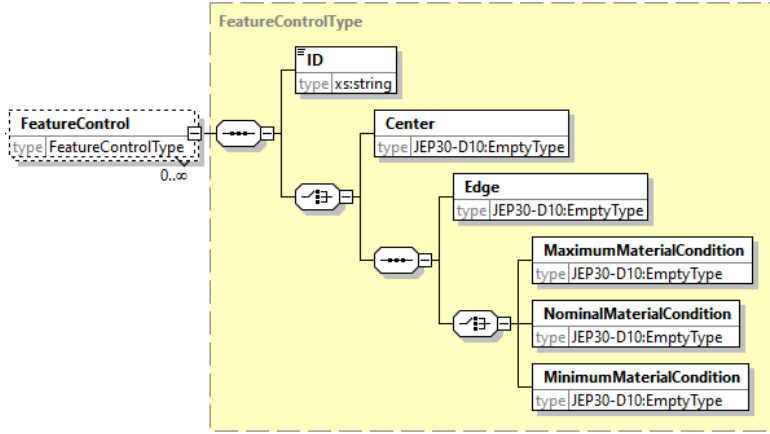
5.2.2.2.1 Size Criteria

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureTypeSelection/SizeCriteria
diagram	
type	SizeCriteriaType

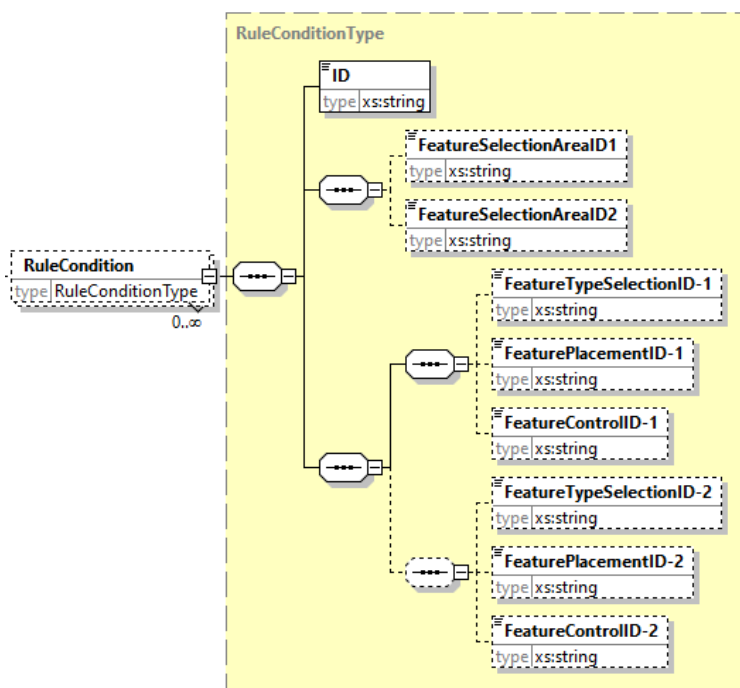
5.2.2.3 Feature Placement

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeaturePlacement
diagram	
type	FeaturePlacementType, JEP30-D10:EmptyType

### 5.2.2.4 Feature Control

path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/FeatureControl</a>
diagram	 <p>The diagram illustrates the structure of the <b>FeatureControlType</b>. It is a tree-like structure starting with a root node <b>FeatureControl</b> (type: FeatureControlType, 0..∞). This node branches into two main paths: <b>ID</b> (type: xs:string) and <b>Center</b> (type: JEP30-D10:EmptyType). The <b>Center</b> node further branches into <b>Edge</b> (type: JEP30-D10:EmptyType) and <b>MaximumMaterialCondition</b> (type: JEP30-D10:EmptyType). The <b>Edge</b> node branches into <b>NominalMaterialCondition</b> (type: JEP30-D10:EmptyType) and <b>MinimumMaterialCondition</b> (type: JEP30-D10:EmptyType).</p>
type	<b>FeatureControlType</b> , JEP30-D10:EmptyType.

### 5.2.2.5 Rule Condition

path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/RuleCondition-Array/RuleCondition</a>
diagram	 <p>The diagram illustrates the structure of the <b>RuleConditionType</b>. It is a tree-like structure starting with a root node <b>RuleCondition</b> (type: RuleConditionType, 0..∞). This node branches into two main paths: <b>ID</b> (type: xs:string) and <b>FeatureSelectionAreaID1</b> (type: xs:string). The <b>FeatureSelectionAreaID1</b> node branches into <b>FeatureSelectionAreaID2</b> (type: xs:string) and <b>FeatureTypeSelectionID-1</b> (type: xs:string). The <b>FeatureTypeSelectionID-1</b> node branches into <b>FeaturePlacementID-1</b> (type: xs:string) and <b>FeatureControlID-1</b> (type: xs:string). The <b>FeaturePlacementID-1</b> node branches into <b>FeatureTypeSelectionID-2</b> (type: xs:string) and <b>FeaturePlacementID-2</b> (type: xs:string). The <b>FeatureTypeSelectionID-2</b> node branches into <b>FeatureControlID-2</b> (type: xs:string).</p>
type	<b>RuleConditionType</b> .

### 5.2.3 Assembly

path	<a href="#">PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/Assembly</a>
diagram	<p>The diagram illustrates the structure of the <b>AssemblyType</b> complex type. It is composed of the following elements in sequence:</p> <ul style="list-style-type: none"> <li><b>ID</b>: type <code>xs:string</code></li> <li><b>Fiducial</b>: type <code>JEP30-D10:EmptyType</code></li> <li><b>Padstack</b>: type <code>JEP30-D10:EmptyType</code></li> <li><b>TestPoint</b>: type <code>JEP30-D10:EmptyType</code></li> <li><b>Bonding</b>: type <code>JEP30-D10:EmptyType</code></li> <li><b>Terminal-To-Pad</b>: type <code>JEP30-D10:EmptyType</code></li> <li><b>Rule-Array</b>: type <code>AssemblyRule-ArrayType</code></li> </ul> <p>An external reference to the <b>AssemblyType</b> is shown on the left, with a cardinality of <code>0..∞</code>.</p>
type	<a href="#">DesignClassification-ArrayType</a> , <a href="#">RuleCondition-ArrayType</a> , <a href="#">AssemblyType</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a>



## 5.2.4 Rule - Array

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/Assembly/Rule-Array
diagram	<pre> classDiagram     class RuleArray {         type AssemblyRule-ArrayType     }     class Rule {         type AssemblyRuleType     }     class Range {         type RangeType     }     class Value {         type xs:decimal     }     class State {         type xs:boolean     }     class Quantity {         type xs:integer     }     class UOM {         type AssemblyRuleUOMType     }     class Dimension {         type JEP30-D10:DimensionUOMType     }     class ViolationConsequence {         type xs:string     }     class RecommendedSolution {         type xs:string     }     class RangeType {         AbsoluteMinimum type xs:decimal         RecommendedMinimum type xs:decimal         UpperRuleMeasurementLimit type xs:decimal         AbsoluteMaximum type xs:decimal         RecommendedMaximum type xs:decimal         LowerRuleMeasurementLimit type xs:decimal     }      RuleArray "1" -- "1..∞" Rule     Rule "1" -- "1..∞" Range     Range "1" -- "1..∞" Value     Range "1" -- "1..∞" State     Range "1" -- "1..∞" Quantity     Range "1" -- "1..∞" UOM     Range "1" -- "1..∞" ViolationConsequence     Range "1" -- "1..∞" RecommendedSolution     Range "1" -- "1..∞" RangeType     UOM "1" -- "1..∞" Dimension     RangeType "1" -- "1..∞" AbsoluteMinimum     RangeType "1" -- "1..∞" RecommendedMinimum     RangeType "1" -- "1..∞" UpperRuleMeasurementLimit     RangeType "1" -- "1..∞" AbsoluteMaximum     RangeType "1" -- "1..∞" RecommendedMaximum     RangeType "1" -- "1..∞" LowerRuleMeasurementLimit </pre>
type	AssemblyRule-ArrayType, AssemblyRuleType, RangeType, AssemblyRuleUOMType, JEP30-D10:DimensionUOMType

5.2.5 Footnote - Array

path	PartModel/DesignKitSection/PackageAssemblyDesignKit-Array/PackageAssemblyDesignKit/Footnote-Array
diagram	<p>The diagram illustrates the structure of the <b>JEP30-D10:Footnote-ArrayType</b> and the <b>FootnoteType</b>.</p> <p><b>JEP30-D10:Footnote-ArrayType</b> is an array type containing <b>FootnoteType</b> elements. The cardinality is <b>0..∞</b>.</p> <p><b>FootnoteType</b> is a complex type with two attributes:</p> <ul style="list-style-type: none"><li><b>ID</b>: type <b>xs:string</b>, marked as <b>if</b> (optional).</li><li><b>Footnote</b>: type <b>xs:string</b>.</li></ul> <p>A <b>constraints</b> section is defined for <b>FootnoteType</b>:</p> <ul style="list-style-type: none"><li><b>unique PackageAssemblyDesignKitFootnoteKey</b>:<ul style="list-style-type: none"><li>selector: <b>Footnote</b></li><li>field: <b>ID</b></li></ul></li></ul>
type	JEP30-D10:Footnote-ArrayType, FootnoteType

### 5.3 Package Substrate Design Kit - Array

path	PartModel/DesignKitSection/PackageSubstrateDesignKit-Array
diagram	
type	PackageSubstrateDesignKit-ArrayType, PackageSubstrateDesignKitType, DesignClassification-ArrayType, RuleCondition-ArrayType, FabricationType, JEP30-D10:Footnote-ArrayType, ds:SignatureType

5.3.1 Fabrication

path	PartModel/DesignKitSection/PackageSubstrateDesignKit-Array/PackageSubstrateDesignKit/Fabrication
diagram	<p>The diagram illustrates the <b>FabricationType</b> complex type. It features an <b>ID</b> attribute of type <code>xs:string</code>. The content model includes the following elements:</p> <ul style="list-style-type: none"><li><b>Drill</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Signal</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Power</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Soldermask</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Silkscreen</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Profile</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Etching</b>: type <code>JEP30-D10:EmptyType</code></li><li><b>Rule-Array</b>: type <code>FabricationRule-ArrayType</code> (required)</li></ul> <p>A dashed box on the left indicates the <b>Fabrication</b> element of type <code>FabricationType</code> with a cardinality of <code>0..∞</code>.</p>
type	FabricationType, JEP30-D10:EmptyType, FabricationRule-ArrayType.

### 5.3.2 Rule - Array

path	PartModel/DesignKitSection/PackageSubstrateDesignKit-Array/PackageSubstrateDesignKit/Fabrication/Rule-Array
diagram	<pre> classDiagram     class RuleArray {         type FabricationRule-ArrayType     }     class Rule {         type FabricationRuleType     }     class RangeType {         AbsoluteMinimum xs:decimal         RecommendedMinimum xs:decimal         UpperRuleMeasurementLimit xs:decimal         AbsoluteMaximum xs:decimal         RecommendedMaximum xs:decimal         LowerRuleMeasurementLimit xs:decimal     }     class FabricationRuleUOMType {         Dimension type JEP30-D10:DimensionUOMType     }     RuleArray "1" -- "1..∞" Rule     Rule "1" -- "1" RangeType     Rule "1" -- "1" FabricationRuleUOMType     Rule "1" -- "1..∞" ViolationConsequence     Rule "1" -- "1..∞" RecommendedSolution     RangeType "1" -- "1" AbsoluteMinimum     RangeType "1" -- "1" RecommendedMinimum     RangeType "1" -- "1" UpperRuleMeasurementLimit     RangeType "1" -- "1" AbsoluteMaximum     RangeType "1" -- "1" RecommendedMaximum     RangeType "1" -- "1" LowerRuleMeasurementLimit     FabricationRuleUOMType "1" -- "1" Dimension     </pre>
type	FabricationRule-ArrayType, FabricationRuleType, RangeType, FabricationRuleUOMType, JEP30-D10:DimensionUOMType

5.4 Material Design Kit - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array
diagram	<p>The diagram illustrates the structure of the <b>MaterialDesignKit-ArrayType</b>. It features a main container box labeled <b>MaterialDesignKit-ArrayType</b> with a dashed border. Inside this container, there are three sub-components: <b>Material-Array</b>, <b>MaterialClassification-Array</b>, and <b>MaterialDesignKit</b>. Each sub-component has its own box and associated type definitions. <b>Material-Array</b> is defined as <b>type MDK-Material-ArrayType</b>. <b>MaterialClassification-Array</b> is defined as <b>type MDK-MaterialClassification-ArrayType</b>. <b>MaterialDesignKit</b> is defined as <b>type MaterialDesignKitType</b> with a multiplicity of <b>1..∞</b>. A <b>constraints</b> box is also present, indicating that there are constraints on the structure. The diagram uses various symbols to represent relationships and multiplicities, such as the <b>1..∞</b> multiplicity on the <b>MaterialDesignKit</b> box and the <b>1..∞</b> multiplicity on the <b>MaterialDesignKit</b> box.</p>
type	<b>MaterialDesignKit-ArrayType</b> , <b>MDK-Material-ArrayType</b> , <b>MDK-MaterialClassification-ArrayType</b> , <b>MaterialDesignKitType</b> ,

### 5.4.1 Material - Array

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/Material-Array</a>
diagram	<p>The diagram illustrates the structure of the <b>Material-Array</b> type. It is composed of several nested and associated types:</p> <ul style="list-style-type: none"> <li><b>MDK-Material-ArrayType</b> (type MDK-Material-ArrayType) contains an array of <b>Material</b> (type MDK-MaterialType).</li> <li><b>MDK-MaterialType</b> (type MDK-MaterialType) contains:             <ul style="list-style-type: none"> <li><b>ID</b> (type xs:string)</li> <li><b>DocID</b> (type xs:string)</li> <li><b>Comment</b> (type xs:string)</li> </ul> </li> <li><b>MDK-MaterialIdentityType</b> (type MDK-MaterialIdentityType) contains:             <ul style="list-style-type: none"> <li><b>Name</b> (type xs:string)</li> <li><b>ShortName</b> (type xs:string)</li> <li><b>Description</b> (type xs:string)</li> <li><b>Class</b> (type MDK-MaterialClassType)</li> <li><b>Composition</b> (type xs:string)</li> <li><b>MaterialCondition</b> (type xs:string)</li> <li><b>Form</b> (type xs:string)</li> <li><b>Authority</b> (type xs:string)</li> <li><b>AuthoritiesMaterial-ID</b> (type xs:string)</li> <li><b>ManufacturerID</b> (type xs:string)</li> </ul> </li> <li>Standalone elements:             <ul style="list-style-type: none"> <li><b>MaterialClassificationID</b> (type xs:string)</li> <li><b>DocumentID</b> (type xs:string)</li> <li><b>MaterialSignature</b> (type ds:SignatureType)</li> </ul> </li> </ul> <p>Constraints are indicated by a small icon at the bottom left of the diagram area.</p>
type	<a href="#">MDK-Material-ArrayType</a> , <a href="#">MDK-MaterialType</a> , <a href="#">MDK-MaterialIdentityType</a> , <a href="#">MDK-MaterialClassType</a> , <a href="#">ds:SignatureType</a>

The enumerated values for the [MDK-MaterialClassType](#) are

- Ceramic,
- Composite,
- Fluid,
- Glass,
- Metal,
- Polymer,
- Semiconductor.

## 5.4.2 Material Classification - Array

path	<b>PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialClassification-Array</b>
diagram	<p>The diagram illustrates the structure of the <b>MaterialClassification-Array</b>. It is an array of <b>MaterialClassification</b> objects. Each <b>MaterialClassification</b> object has the following attributes:</p> <ul style="list-style-type: none"> <li><b>ID</b>: type xs:string (required, key)</li> <li><b>Name</b>: type xs:string (required)</li> <li><b>Authority</b>: type xs:string (optional)</li> <li><b>AuthoritiesClassification-ID</b>: type xs:string (optional)</li> <li><b>ParentMaterialClassificationID</b>: type xs:string (optional, key)</li> <li><b>DocumentID</b>: type xs:string (optional)</li> <li><b>MaterialClassificationSignature</b>: type ds:SignatureType (optional)</li> </ul> <p>The diagram also shows a <b>constraints</b> section.</p>
type	<b>MDK-MaterialClassification-ArrayType, MDK-MaterialClassificationType, ds:SignatureType.</b>

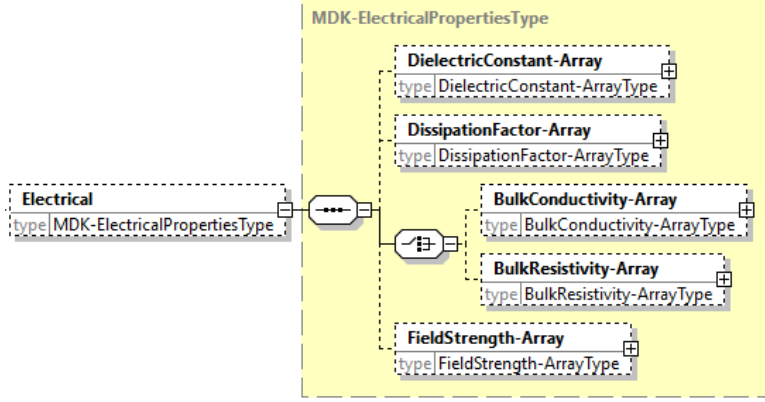


### 5.4.3 Material Design Kit

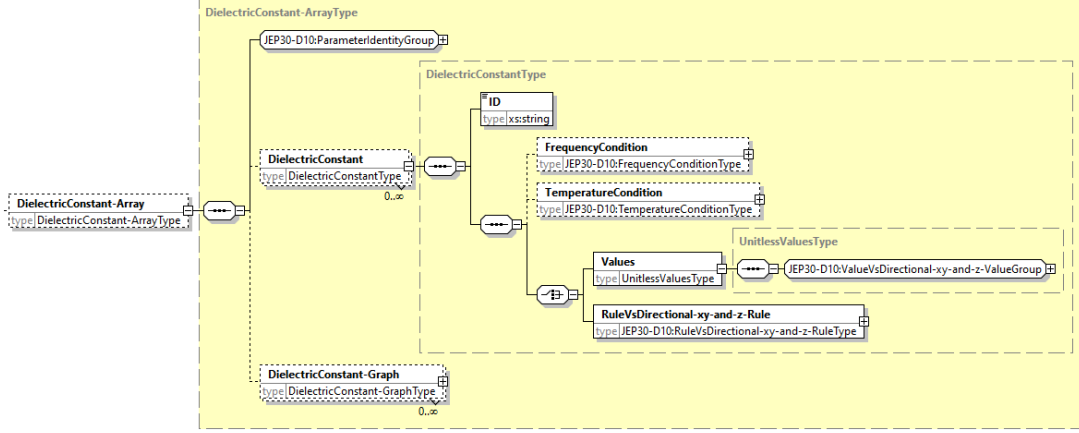
path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit</a>
diagram	<pre> classDiagram     class MaterialDesignKitType {         ID xs:string         MaterialID xs:string         Electrical MDK-ElectricalPropertiesType         Thermal MDK-ThermalPropertiesType         Structural MDK-StructuralPropertiesType         Optical MDK-OpticalPropertiesType         OtherProperty-Array MDK-OtherProperty-ArrayType         Footnote-Array JEP30-D10:Footnote-ArrayType         DocumentID xs:string         MaterialDesignKitSignature ds:SignatureType     }     class MaterialDesignKit {         type MaterialDesignKitType     }     MaterialDesignKit "1..∞" --&gt; "1" MaterialDesignKitType     </pre>
type	<a href="#">MaterialDesignKitType</a> , <a href="#">MDK-ElectricalPropertiesType</a> , <a href="#">MDK-ThermalPropertiesType</a> , <a href="#">MDK-StructuralPropertiesType</a> , <a href="#">MDK-OpticalPropertiesType</a> , <a href="#">MDK-OtherProperty-ArrayType</a> <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a>

The Conditional properties and the property units defined under the respective properties for Electrical, Thermal, Structural and Optical are specially configured to suit those properties, however they all have a common structure and common graph formatting. These common structures are defined in more detail in section 5.4.3.5 Common Structure applied to all Properties.

### 5.4.3.1 Electrical

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical
diagram	 <p>The diagram shows a hierarchical structure for MDK-ElectricalPropertiesType. It is a container for several array types: DielectricConstant-Array, DissipationFactor-Array, BulkConductivity-Array, BulkResistivity-Array, and FieldStrength-Array. Each array type is represented by a box with a plus sign in the top right corner. The MDK-ElectricalPropertiesType box is a larger container with a dashed border, and the arrays are nested within it. The DielectricConstant-Array is the first, followed by DissipationFactor-Array, then BulkConductivity-Array and BulkResistivity-Array (which are grouped together), and finally FieldStrength-Array.</p>
type	MDK-ElectricalPropertiesType, DielectricConstant-ArrayType, DissipationFactor-ArrayType, BulkConductivity-ArrayType, BulkResistivity-ArrayType, FieldStrength-ArrayType

#### 5.4.3.1.1 Dielectric Constant - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/DielectricConstant-Array
diagram	 <p>The diagram shows the structure of DielectricConstant-ArrayType. It is a container for several types: DielectricConstant, DielectricConstant-Graph, and a JEP30-D10:ParameterIdentityGroup. The DielectricConstant type is further detailed as containing an ID (xs:string), a FrequencyCondition (JEP30-D10:FrequencyConditionType), a TemperatureCondition (JEP30-D10:TemperatureConditionType), and a RuleVsDirectional-xy-and-z-Rule (JEP30-D10:RuleVsDirectional-xy-and-z-RuleType). The RuleVsDirectional-xy-and-z-Rule type is further detailed as containing a Values (UnitlessValuesType) and a JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup. The DielectricConstant-Graph type is also shown as a container for a DielectricConstant-GraphType. The JEP30-D10:ParameterIdentityGroup is shown as a container for a JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.</p>
type	DielectricConstant-ArrayType, DielectricConstantType, JEP30-D10:FrequencyConditionType, JEP30-D10:TemperatureConditionType, UnitlessValuesType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, DielectricConstant-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

### 5.4.3.1.1.1 Dielectric Constant Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/DielectricConstant-Array/DielectricConstant-Graph
diagram	
type	DielectricConstant-GraphType, JEP30-D10:Temp-or-FreqParametricGraphChartX-AxisType, Temp-or-FreqTestConditionUnitsType, GraphChartX-AxisFormattingType, JEP30-D10:UnitlessParameterGraphChartY-AxisType, GraphChartY-AxisFormattingType, DielectricConstantData-ArrayType, JEP30-D10:Temp-or-FreqPlotTestConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

5.4.3.1.2 Dissipation Factor - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/DissipationFactor-Array
diagram	
type	DissipationFactor-ArrayType, DissipationFactorType, JEP30-D10:FrequencyConditionType, JEP30-D10:TemperatureConditionType, UnitlessValuesType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, DissipationFactor-GraphType.
group	JEP30-D10:ParameterIdentityGroup'

### 5.4.3.1.2.1 Dissipation Factor Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/DissipationFactor-Array/DissipationFactor-Graph
diagram	
type	DissipationFactor-GraphType, JEP30-D10:Temp-or-FreqParametricGraphChartX-AxisType, Temp-or-FreqTestConditionUnitsType, GraphChartX-AxisFormattingType, JEP30-D10:UnitlessParameterGraphChartY-AxisType, GraphChartY-AxisFormattingType, DissipationFactorData-ArrayType, JEP30-D10:Temp-or-FreqPlotTestConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

5.4.3.1.3 Bulk Conductivity - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/BulkConductivity-Array
diagram	
type	BulkConductivity-ArrayType, BulkConductivityType, JEP30-D10:TemperatureConditionType, BulkConductivityValuesType, BulkConductivityUOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, BulkConductivity-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The *BulkConductivityUOM* enumerated value is S/m.

### 5.4.3.1.3.1 Bulk Conductivity Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/BulkConductivity-Array/BulkConductivity-Graph
diagram	
type	BulkConductivity-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, BulkConductivityParameterGraphChartY-AxisType, BulkConductivityUOMType, BulkConductivityData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

The enumerated values for *Temperature-in-Celsius-or-KelvinUOMType* are DegC and K

#### 5.4.3.1.4 Bulk Resistivity - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/BulkResistivity-Array
diagram	<pre> classDiagram     class BulkResistivityArrayType {         JEP30-D10:ParameterIdentityGroup     }     class BulkResistivityArray {         type BulkResistivityArrayType     }     class BulkResistivity {         type BulkResistivityType     }     class BulkResistivityGraph {         type BulkResistivity-GraphType     }     class ID {         type xs:string     }     class TemperatureCondition {         type JEP30-D10:TemperatureConditionType     }     class Values {         type BulkResistivityValuesType     }     class Rule {         type JEP30-D10:RuleType     }     class BulkResistivityUOM {         type BulkResistivityUOMType     }     class JEP30D10ValueVsDirectionalxyandzValueGroup {         type JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup     }     class RuleGroup {         type RuleGroup     }      BulkResistivityArrayType -- &gt; BulkResistivityArray     BulkResistivityArrayType -- BulkResistivity : 0..∞     BulkResistivityArrayType -- BulkResistivityGraph : 0..∞     BulkResistivity -- ID     BulkResistivity -- TemperatureCondition     BulkResistivity -- Values     BulkResistivity -- Rule : 1..∞     Values -- BulkResistivityUOM     Values -- JEP30D10ValueVsDirectionalxyandzValueGroup     Rule -- RuleGroup     </pre>
type	BulkResistivity-ArrayType, BulkResistivityType, JEP30-D10:TemperatureConditionType, BulkResistivityValuesType, BulkResistivityUOMType, JEP30-D10:RuleType, BulkResistivity-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The *BulkResistivityUOM* enumerated value is Ohm\*m.



#### 5.4.3.1.4.1 Bulk Resistivity Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/BulkResistivity-Array/BulkResistivity-Graph
diagram	
type	BulkResistivity-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, BulkResistivityParameterGraphChartY-AxisType, BulkResistivityUOMType, BulkResistivityData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

5.4.3.1.5 Field Strength - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/FieldStrength-Array
diagram	
type	FieldStrength-ArrayType, FieldStrengthType, JEP30-D10:FrequencyConditionType, JEP30-D10:TemperatureConditionType, FieldStrengthValuesType, FieldStrengthUOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, FieldStrength-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

### 5.4.3.1.5.1 Field Strength Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/FieldStrength-Array/FieldStrength-Graph
diagram	
type	FieldStrength-GraphType, JEP30-D10:Temp-or-FreqParametricGraphChartX-AxisType, Temp-or-FreqTestConditionUnitsType, GraphChartX-AxisFormattingType, JEP30-D10:UnitlessParameterGraphChartY-AxisType, GraphChartY-AxisFormattingType, FieldStrengthData-ArrayType, JEP30-D10:Temp-or-FreqPlotTestConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

### 5.4.3.2 Thermal

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal
diagram	
type	MDK-ThermalPropertiesType, GlassTransitionTemperature-ArrayType, MeltingTemperatureType, ThermalExpansion-ArrayType, ThermalConductivity-ArrayType, SpecificHeat-ArrayType, Density-ArrayType

#### 5.4.3.2.1 Glass Transition Temperature - Array

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/GlassTransitionTemperature-Array</a>
diagram	
type	<a href="#">GlassTransitionTemperature-ArrayType</a> , <a href="#">GlassTransitionTemperatureType</a> , <a href="#">JEP30-D10:ValueSetGroupType</a> , <a href="#">GlassTransitionTemperatureTestMethodType</a> , <a href="#">JEP30-D10:Temperature-in-CelsiusUOMType</a> .

The enumerated values of the *TestMethod* are

- Dynamic Mechanical Analysis
- Differential Scanning Calorimeter
- Thermo-Mechanical Analysis

The temperature *UOM* is restricted to DegC for this parameter.

#### 5.4.3.2.2 Melting Temperature - Array

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/MeltingTemperature</a>
diagram	
type	<a href="#">MeltingTemperatureType</a> , <a href="#">JEP30-D10:ValueSetGroupType</a> , <a href="#">JEP30-D10:Temperature-in-Celsius-or-KelvinUOMType</a>

The temperature *UOM* is restricted to DegC and K for this parameter.

#### 5.4.3.2.3 Thermal Expansion - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/ThermalExpansion-Array
diagram	<pre> classDiagram     class ThermalExpansionArray {         type ThermalExpansionArrayType     }     class ThermalExpansion {         type ThermalExpansionType     }     class ThermalExpansionType {         ID xs:string     }     class TemperatureCondition {         type JEP30-D10:TemperatureConditionType     }     class Values {         type ThermalExpansionValuesType     }     class RuleVsDirectionalXyAndZRule {         type JEP30-D10:RuleVsDirectional-xy-and-z-RuleType     }     class ThermalExpansionGraph {         type ThermalExpansionGraphType     }     class ThermalExpansionUOM {         type ThermalExpansionUOMType     }     class JEP30D10ParameterIdentityGroup {         type JEP30-D10:ParameterIdentityGroupType     }     class JEP30D10ValueVsDirectionalXyAndZValueGroup {         type JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroupType     }      ThermalExpansionArray "1" -- "*" ThermalExpansion     ThermalExpansion "1" -- "0..∞" ThermalExpansionType     ThermalExpansionType "1" -- "1" ID     ThermalExpansionType "1" -- "1" TemperatureCondition     ThermalExpansionType "1" -- "1" Values     ThermalExpansionType "1" -- "1" RuleVsDirectionalXyAndZRule     ThermalExpansionType "1" -- "0..∞" ThermalExpansionGraph     ThermalExpansionType "1" -- "1" ThermalExpansionUOM     ThermalExpansionType "1" -- "1" JEP30D10ParameterIdentityGroup     ThermalExpansionType "1" -- "1" JEP30D10ValueVsDirectionalXyAndZValueGroup     </pre> <p>The diagram illustrates the structure of the ThermalExpansion-ArrayType. It shows a hierarchy where ThermalExpansion-ArrayType contains multiple ThermalExpansion objects. Each ThermalExpansion object has a single ThermalExpansionType associated with it. The ThermalExpansionType further defines several properties: a unique identifier (ID), a reference to a TemperatureCondition, a set of values (Values), a reference to a RuleVsDirectional-xy-and-z-Rule, a collection of ThermalExpansion-Graphs, a reference to a ThermalExpansionUOM, and a reference to a JEP30-D10:ParameterIdentityGroup. Additionally, there is a reference to a JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.</p>
type	ThermalExpansion-ArrayType, ThermalExpansionType, JEP30-D10:TemperatureConditionType, ThermalExpansionValuesType, ThermalExpansionUOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, ThermalExpansion-Graph
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The *ThermalExpansionUOM* is restricted to 1/DegC and 1/K for this parameter.

### 5.4.3.2.3.1 Thermal Expansion Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/ThermalExpansion-Array/ThermalExpansion-Graph
diagram	
type	ThermalExpansion-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, ThermalExpansionParameterGraphChartY-AxisType, ThermalExpansionUOMType, ThermalExpansionData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

5.4.3.2.4 Thermal Conductivity - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/ThermalConductivity-Array
diagram	
type	ThermalConductivity-ArrayType, ThermalConductivityType, JEP30-D10:TemperatureConditionType, ThermalConductivityValuesType, ThermalConductivityUOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, ThermalConductivity-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The *ThermalConductivityUOM* is restricted to W/m.K for this parameter.



#### 5.4.3.2.4.1 Thermal Conductivity Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/ThermalConductivity-Array/ThermalConductivity-Graph
diagram	<pre> classDiagram     class ThermalConductivity-GraphType {         GraphTitle xs:string         TestConditionDefinition JEP30-D10:TemperatureParametricGraphChartX-AxisType         ParameterDefinition ThermalConductivityParameterGraphChartY-AxisType         Data-Array ThermalConductivityData-ArrayType         GraphFormula JEP30-D10:GraphMathML-FormulaType         Formatting JEP30-D10:GraphFormattingType     }     class JEP30-D10:TemperatureParametricGraphChartX-AxisType {         AxisParameterIdentityGroup         TemperatureUOM Temperature-in-Celsius-or-KelvinUOMType         Formatting GraphChartX-AxisFormattingType     }     class ThermalConductivityParameterGraphChartY-AxisType {         ID xs:string         JEP30-D10:AxisParameterIdentityGroup         ThermalConductivityUOM ThermalConductivityUOMType         Formatting JEP30-D10:GraphChartY-AxisFormattingType     }     class ThermalConductivityData-ArrayType {         ParameterDefinitionID xs:string         PlotTestCondition JEP30-D10:TemperatureGraphPlotConditionType         Data JEP30-D10:GraphDataType         Formatting JEP30-D10:GraphDataFormattingType     }     class JEP30-D10:GraphMathML-FormulaType     class JEP30-D10:GraphFormattingType      ThermalConductivity-GraphType "1" -- "0..∞" JEP30-D10:TemperatureParametricGraphChartX-AxisType     ThermalConductivity-GraphType "1" -- "1..∞" ThermalConductivityParameterGraphChartY-AxisType     ThermalConductivity-GraphType "1" -- "1..∞" ThermalConductivityData-ArrayType     ThermalConductivity-GraphType "1" -- "1..∞" JEP30-D10:GraphMathML-FormulaType     ThermalConductivity-GraphType "1" -- "1..∞" JEP30-D10:GraphFormattingType     </pre> <p>constraints</p>
type	ThermalConductivity-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, ThermalConductivityParameterGraphChartY-AxisType, ThermalConductivityUOMType, ThermalConductivityData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

5.4.3.2.5 Specific Heat - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/SpecificHeat-Array
diagram	<p>The diagram illustrates the structure of the <b>SpecificHeat-ArrayType</b>. It is a class that contains a <b>SpecificHeat-Array</b> (type <b>SpecificHeat-ArrayType</b>) and a <b>SpecificHeat-Graph</b> (type <b>SpecificHeat-GraphType</b>). The <b>SpecificHeat-Array</b> is associated with <b>SpecificHeatType</b> (type <b>SpecificHeatType</b>) with a multiplicity of 0..∞. The <b>SpecificHeatType</b> is associated with <b>TemperatureCondition</b> (type <b>JEP30-D10:TemperatureConditionType</b>) with a multiplicity of 0..∞. The <b>TemperatureCondition</b> is associated with <b>Value</b> (type <b>xs:decimal</b>), <b>SpecificHeatUOM</b> (type <b>SpecificHeatUOMType</b>), <b>FootnoteID</b> (type <b>xs:string</b>), and <b>TestMethod</b> (type <b>xs:string</b>). The <b>SpecificHeatUOM</b> is associated with <b>FootnoteID</b> (type <b>xs:string</b>) with a multiplicity of 0..∞. The <b>FootnoteID</b> is associated with <b>TestMethod</b> (type <b>xs:string</b>) with a multiplicity of 0..∞. The <b>TestMethod</b> is associated with <b>Rule</b> (type <b>JEP30-D10:RuleType</b>) with a multiplicity of 1..∞. The diagram also shows a <b>JEP30-D10:ParameterIdentityGroup</b> association with <b>SpecificHeat-ArrayType</b>.</p>
type	<b>SpecificHeat-ArrayType</b> , <b>SpecificHeatType</b> , <b>JEP30-D10:TemperatureConditionType</b> , <b>SpecificHeat-UOMType</b> , <b>JEP30-D10:RuleType</b> , <b>SpecificHeat-GraphType</b> .
group	<b>JEP30-D10:ParameterIdentityGroup</b> .

The *SpecificHeatUOM* is restricted to J/(g\*degC) and J/(g\*K) for this parameter.

### 5.4.3.2.5.1 Specific Heat Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/SpecificHeat-Array/SpecificHeat-Graph
diagram	
type	SpecificHeat-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, SpecificHeatParameterGraphChartY-AxisType, SpecificHeatUOMType, SpecificHeatData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataTypes, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

#### 5.4.3.2.6 Density - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Thermal/Density-Array
diagram	<p>The diagram illustrates the structure of the <b>Density-Array</b> element. It is a sequence of <b>Density</b> elements (type <b>DensityType</b>). Each <b>Density</b> element contains a sequence of <b>ID</b> (type <b>xs:string</b>), <b>TemperatureCondition</b> (type <b>JEP30-D10:TemperatureConditionType</b>), <b>Value</b> (type <b>JEP30-D10:ValueSetGroupType</b>), <b>DensityUOM</b> (type <b>DensityUOMType</b>), <b>TestMethod</b> (type <b>xs:string</b>), and <b>Rule</b> (type <b>JEP30-D10:RuleType</b>). Additionally, there is a <b>Density-Graph</b> (type <b>Density-GraphType</b>) element.</p>
type	<b>Density-ArrayType</b> , <b>DensityType</b> , <b>JEP30-D10:TemperatureConditionType</b> , <b>JEP30-D10:ValueSetGroupType</b> , <b>Density-UOMType</b> , <b>JEP30-D10:RuleType</b> , <b>Density-GraphType</b> ,
group	<b>JEP30-D10:ParameterIdentityGroup</b> .

The **DensityUOM** is restricted to kg/m<sup>3</sup> and g/cm<sup>3</sup> for this parameter.

#### 5.4.3.2.6.1 Density Graph

[illegible]

### 5.4.3.3 Structural

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural
diagram	
type	MDK-StructuralPropertiesType, PoissonRatio-ArrayType, Stress-ArrayType, YieldStrength-ArrayType, FailureStrength-ArrayType, JEP30-D10:CTE-ArrayType, JEP30-D10:YoungsModulus-ArrayType.

#### 5.4.3.3.1 Poisson Ratio - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/PoissonRatio-Array
diagram	
type	PoissonRatio-ArrayType, PoissonRatioType, JEP30-D10:TemperatureConditionType, UnitlessValuesType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, PoissonRatio-GraphType.
group	JEP30-D10:ParameterIdentityGroup.

### 5.4.3.3.1.1 Poisson Ratio Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/PoissonRatio-Array/PoissonRatio-Graph
diagram	<pre> classDiagram     class PoissonRatio-GraphType {         +xs:string GraphTitle         +JEP30-D10:TemperatureParametricGraphChartX-AxisType TestConditionDefinition         +JEP30-D10:UnitlessParameterGraphChartY-AxisType ParameterDefinition         +PoissonRatioData-ArrayType Data-Array         +JEP30-D10:GraphMathML-FormulaType GraphFormula         +JEP30-D10:GraphFormattingType Formatting     }     class JEP30-D10:TemperatureParametricGraphChartX-AxisType {         +TemperatureUOM         +Formatting     }     class JEP30-D10:UnitlessParameterGraphChartY-AxisType {         +ID         +Formatting     }     class PoissonRatioData-ArrayType {         +ParameterDefinitionID         +JEP30-D10:TemperatureGraphPlotConditionType PlotTestCondition         +JEP30-D10:GraphDataType Data         +JEP30-D10:GraphDataFormattingType Formatting     }     PoissonRatio-GraphType "1" -- "0..∞" JEP30-D10:TemperatureParametricGraphChartX-AxisType     PoissonRatio-GraphType "1" -- "1..∞" JEP30-D10:UnitlessParameterGraphChartY-AxisType     PoissonRatio-GraphType "1" -- "1..∞" PoissonRatioData-ArrayType     PoissonRatio-GraphType "1" -- "1..∞" JEP30-D10:GraphMathML-FormulaType     PoissonRatio-GraphType "1" -- "1..∞" JEP30-D10:GraphFormattingType     JEP30-D10:TemperatureParametricGraphChartX-AxisType "1" -- "1..∞" TemperatureUOM     JEP30-D10:TemperatureParametricGraphChartX-AxisType "1" -- "1..∞" Formatting     JEP30-D10:UnitlessParameterGraphChartY-AxisType "1" -- "1..∞" ID     JEP30-D10:UnitlessParameterGraphChartY-AxisType "1" -- "1..∞" Formatting     PoissonRatioData-ArrayType "1" -- "0..∞" ParameterDefinitionID     PoissonRatioData-ArrayType "1" -- "0..∞" JEP30-D10:TemperatureGraphPlotConditionType     PoissonRatioData-ArrayType "1" -- "1..∞" JEP30-D10:GraphDataType     PoissonRatioData-ArrayType "1" -- "1..∞" JEP30-D10:GraphDataFormattingType     </pre>
type	PoissonRatio-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, PoissonRatioParameterGraphChartY-AxisType, PoissonRatioData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

#### 5.4.3.3.2 Stress - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/Stress-Array
diagram	<pre> classDiagram     class StressArrayType {         JEP30-D10:ParameterIdentityGroup     }     class StressType {         ID xs:string     }     class StrainConditionType {         StrainSymbol xs:string         Value JEP30-D10:ValueSetGroupType         StrainUOM StrainUOMType     }     class StrainRateConditionType {         StrainRateSymbol xs:string         Value JEP30-D10:ValueSetGroupType         StrainRateUOM StrainRateUOMType     }     class TemperatureConditionType {         JEP30-D10:TemperatureConditionType     }     class StressValuesType {         Values StressValuesType         StressUOM StressUOMType     }     class RuleVsDirectional_xy_and_z_Rule {         JEP30-D10:RuleVsDirectional-xy-and-z-RuleType     }     class StressArrayType {         Stress StressType     }     class StressType {         StrainCondition StrainConditionType         StrainRateCondition StrainRateConditionType         TemperatureCondition TemperatureConditionType         Values StressValuesType         RuleVsDirectional_xy_and_z_Rule RuleVsDirectional-xy-and-z-RuleType     }     class StressGraphType {         Stress-Graph Stress-GraphType     } </pre>
type	Stress-ArrayType, StressType, StrainConditionType, JEP30-D10:ValueSetGroupType, StrainUOMType, StrainRateConditionType, StrainRateUOMType, JEP30-D10:TemperatureConditionType, StressValuesType, StressUOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, Stress-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The *StressUOM* is restricted to Pa and MPa for this parameter.



### 5.4.3.3.2.1 Stress Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/Stress-Array/Stress-Graph
diagram 1 of 2	
type	<b>Stress-GraphType, StressMDK-TestConditionParametricGraphChartX-AxisTypeType,</b> <b>StressTestConditionUnitsType, JEP30-D10:GraphChartX-AxisFormattingType</b> <b>StressParameterGraphChartY-AxisType, StressUOMType, JEP30-D10:GraphChartY-AxisFormattingType,</b> <b>StressData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType,</b> <b>JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType,</b> <b>JEP30-D10:GraphFormattingType</b>
group	<b>JEP30-D10:AxisParameterIdentityGroup</b>

#### 5.4.3.3.2.1.1 Units

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/Stress-Array/Stress-Graph/TestConditionDefinition/Units</a>
diagram	
type	<a href="#">StressTestConditionUnitsType</a> , <a href="#">StrainUOMType</a> , <a href="#">StrainRateUOMType</a> , <a href="#">JEP30-D10:Temperature-in-Celsius-or-KelvinUOMType</a> ,

#### 5.4.3.3.2.1.2 Stress Graph Plot Test Condition

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/Stress-Array/Stress-Graph/Data-Array/PlotTestCondition</a>
diagram	
type	<a href="#">StressGraphPlotTestConditionType</a> , <a href="#">JEP30-D10:ValueSetGroupType</a> , <a href="#">StressTestConditionUnitsType</a> , <a href="#">JEP30-D10:GraphDataFormattingLegendType</a> .
group	<a href="#">JEP30-D10:ParameterIdentityGroup</a> , <a href="#">JEP30-D10:RuleGroup</a>

### 5.4.3.3.3 Yield Strength - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/YieldStrength-Array
diagram	
type	YieldStrength-ArrayType, YieldStrengthType, JEP30-D10:TemperatureConditionType, YieldStrengthValuesType, YieldStrengthUOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, YieldStrength-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The *YieldStrengthUOM* is restricted to Pa and MPa for this parameter.

### 5.4.3.3.1 Yield Strength Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/YieldStrength-Array/YieldStrength-Graph
diagram	
type	YieldStrength-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, YieldStrengthParameterGraphChartY-AxisType, YieldStrengthUOMType, YieldStrengthData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

#### 5.4.3.3.4 Failure Strength - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/FailureStrength-Array
diagram	
type	FailureStrength-ArrayType, FailureStrengthType, JEP30-D10:TemperatureConditionType, FailureStrengthValuesType, FailureStrength-UOMType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, FailureStrength-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

The Failure Strength UOM is restricted to Pa for this parameter.

#### 5.4.3.3.4.1 Failure Strength Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/FailureStrength-Array/FailureStrength-Graph
diagram	<pre> classDiagram     class FailureStrength-GraphType {         +GraphTitle xs:string     }     class JEP30-D10-TemperatureParametricGraphChartX-AxisType {         +TemperatureUOM Temperature-in-Celsius-or-KelvinUOMType         +Formatting GraphChartX-AxisFormattingType     }     class FailureStrengthParameterGraphChartY-AxisType {         +ID xs:string         +JEP30-D10-AxisParameterIdentityGroup         +FailureStrengthUOM FailureStrengthUOMType         +Formatting JEP30-D10-GraphChartY-AxisFormattingType     }     class FailureStrengthData-ArrayType {         +ParameterDefinitionID xs:string         +PlotTestCondition JEP30-D10-TemperatureGraphPlotConditionType         +Data JEP30-D10-GraphDataType         +Formatting JEP30-D10-GraphDataFormattingType     }     class Data-Array {         +FailureStrengthData-ArrayType     }     class GraphFormula {         +JEP30-D10-GraphMathML-FormulaType     }     class Formatting {         +JEP30-D10-GraphFormattingType     }     class Constraints      FailureStrength-GraphType "0..*" -- "1" JEP30-D10-TemperatureParametricGraphChartX-AxisType     FailureStrength-GraphType "0..*" -- "1" FailureStrengthParameterGraphChartY-AxisType     FailureStrength-GraphType "0..*" -- "1" FailureStrengthData-ArrayType     FailureStrength-GraphType "0..*" -- "1" Data-Array     FailureStrength-GraphType "0..*" -- "1" GraphFormula     FailureStrength-GraphType "0..*" -- "1" Formatting     FailureStrength-GraphType "0..*" -- "1" Constraints     </pre>
type	FailureStrength-GraphType, JEP30-D10:TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, FailureStrengthParameterGraphChartY-AxisType, FailureStrengthUOMType, FailureStrengthData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

#### 5.4.3.3.5 CTE - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/CTE-Array
diagram	
type	JEP30-D10:CTE-ArrayType, CTEType, TemperatureConditionType, CTE-ValuesType, CTE-UOMType, RuleVsDirectional-xy-and-z-RuleType, CTE-GraphType.
group	ParameterIdentityGroup, ValueVsDirectional-xy-and-z-ValueGroup.

The **CTE-UOM** is restricted to ppm/DegC and ppm/K for this parameter and it is defaulted to ppm/DegC.

### 5.4.3.3.5.1 CTE Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/CTE-Array/CTE-Graph
diagram	<p>The diagram illustrates the structure of the CTE-GraphType. It includes a self-association for GraphTitle (xs:string). It is associated with TestConditionDefinition (TemperatureParametricGraphChartX-AxisType) and ParameterDefinition (CTE-ParametricGraphChartY-AxisType). It also has a self-association for Data-Array (CTE-ParameterGraphData-ArrayType). The diagram includes nested boxes for TemperatureParametricGraphChartX-AxisType, CTE-ParametricGraphChartY-AxisType, and CTE-ParameterGraphData-ArrayType, each containing sub-classes like AxisParameterIdentityGroup, TemperatureUOM, ID, CTE-UOM, ParameterDefinitionID, PlotTestCondition, Data, and GraphFormula. A Formatting class is also shown with a GraphFormattingType association.</p>
type	CTE-GraphType, TemperatureParametricGraphChartX-AxisType, Temperature-in-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, CTE-ParameterGraphChartY-AxisType, CTE-UOMType, CTE-Data-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup



#### 5.4.3.3.6 Youngs Modulus- Array

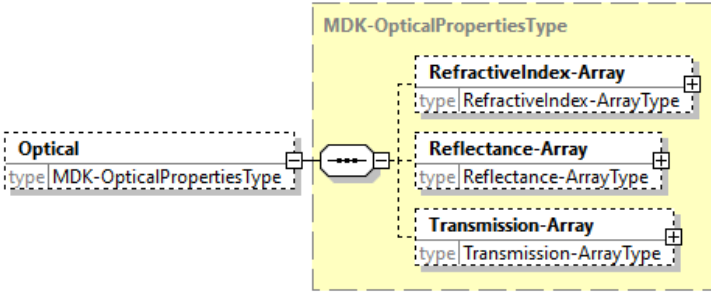
path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/YoungsModulus-Array
diagram	
type	JEP30-D10:YoungsModulus-ArrayType, YoungsModulusType, YoungsModulusType, YoungsModulusValuesType, RuleVsDirectional-xy-and-z-RuleType, , YoungsModulus-GraphType.
group	ParameterIdentityGroup, ValueVsDirectional-xy-and-z-ValueGroup, RuleGroup.

The *YoungsModulus-UOM* is restricted to N/m<sup>2</sup> and GPa for this parameter.

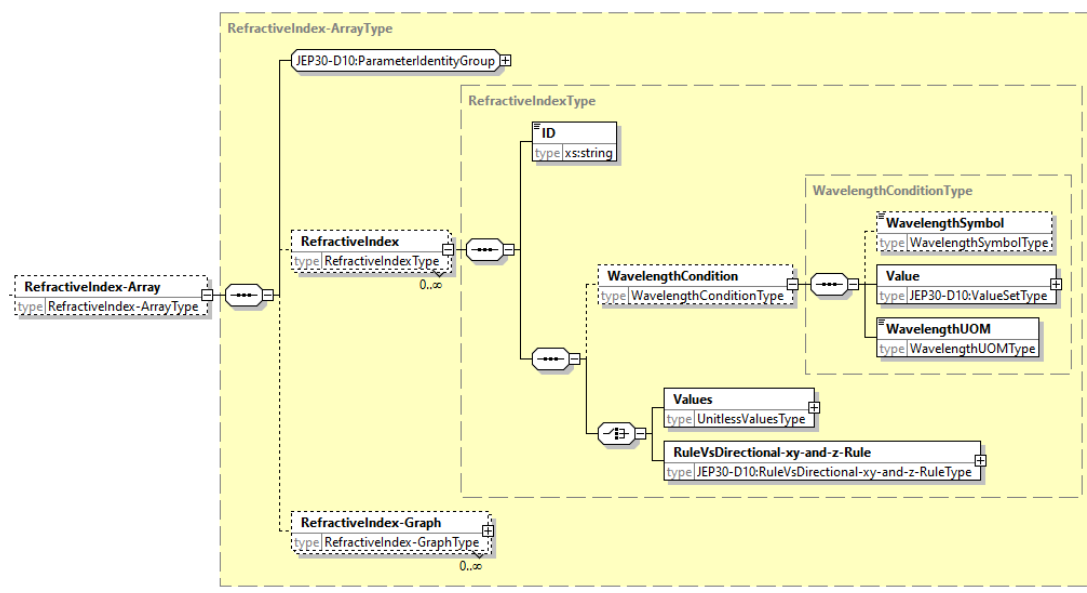
### 5.4.3.3.6.1 Youngs Modulus Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/YoungsModulus-Array/YoungsModulus-Graph
diagram	
type	YoungsModulus-GraphType, TemperatureParametricGraphChartX-AxisType, Temperature-Celsius-or-KelvinUOMType, GraphChartX-AxisFormattingType, YoungsModulusParameterGraphChartY-AxisType, YoungsModulusUOMType, YoungsModulusData-ArrayType, JEP30-D10:TemperatureGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType
group	AxisParameterIdentityGroup

#### 5.4.3.4 Optical

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical
diagram	 <p>The diagram shows a dashed box labeled 'Optical' with 'type MDK-OpticalPropertiesType'. This box is connected to a larger dashed box labeled 'MDK-OpticalPropertiesType'. Inside this box are three sub-entities: 'RefractiveIndex-Array' (type RefractiveIndex-ArrayType), 'Reflectance-Array' (type Reflectance-ArrayType), and 'Transmission-Array' (type Transmission-ArrayType). Each sub-entity has a '+' icon in its top right corner.</p>
type	MDK-OpticalPropertiesType, RefractiveIndex-ArrayType, Reflectance-ArrayType, Transmission-ArrayType.

#### 5.4.3.4.1 Refractive Index - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical/RefractiveIndex-Array
diagram	 <p>The diagram shows a dashed box labeled 'RefractiveIndex-Array' with 'type RefractiveIndex-ArrayType'. This box is connected to a larger dashed box labeled 'RefractiveIndex-ArrayType'. Inside this box are several sub-entities: 'JEP30-D10:ParameterIdentityGroup' (with a '+' icon), 'RefractiveIndex' (type RefractiveIndexType, with a '0..∞' multiplicity), 'WavelengthCondition' (type WavelengthConditionType), 'RefractiveIndex-Graph' (type RefractiveIndex-GraphType, with a '0..∞' multiplicity), 'ID' (type xs:string), 'WavelengthSymbol' (type WavelengthSymbolType), 'Value' (type JEP30-D10:ValueSetType), 'WavelengthUOM' (type WavelengthUOMType), 'Values' (type UnitlessValuesType), and 'RuleVsDirectional-xy-and-z-Rule' (type JEP30-D10:RuleVsDirectional-xy-and-z-RuleType). The 'WavelengthCondition' entity is further expanded to show its internal structure: 'WavelengthSymbol' (type WavelengthSymbolType), 'Value' (type JEP30-D10:ValueSetType), 'WavelengthUOM' (type WavelengthUOMType), 'Values' (type UnitlessValuesType), and 'RuleVsDirectional-xy-and-z-Rule' (type JEP30-D10:RuleVsDirectional-xy-and-z-RuleType).</p>
type	RefractiveIndex-ArrayType, RefractiveIndexType, WavelengthConditionType, WavelengthSymbolType, WavelengthUOMType, UnitlessValuesType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, RefractiveIndex-GraphType.
group	JEP30-D10:ParameterIdentityGroup.

The Wavelength *Symbol* is restricted to Lambda, and the *WavelengthUOM* is restricted to nm for the *WavelengthCondition*.

#### 5.4.3.4.1.1 Refractive Index Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical/RefractiveIndex-Array/RefractiveIndex-Graph
diagram	
type	RefractiveIndex-GraphType, JEP30-D10:WavelengthParametricGraphChartX-AxisType, WavelengthUOMType, GraphChartX-AxisFormattingType, JEP30-D10:UnitlessParameterGraphChartY-AxisType, GraphChartY-AxisFormattingType, RefractiveIndexData-ArrayType, JEP30-D10:WavelengthGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType.
group	AxisParameterIdentityGroup

#### 5.4.3.4.2 Reflectance - Array

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical/Reflectance-Array</a>
diagram	<p>The diagram illustrates the structure of the <b>Reflectance-Array</b> type. It is a dashed box containing several elements:</p> <ul style="list-style-type: none"> <li><b>Reflectance-Array</b> (type <i>Reflectance-ArrayType</i>): The root element, which is a dashed box containing:             <ul style="list-style-type: none"> <li><b>JEP30-D10:ParameterIdentityGroup</b>: A group element.</li> <li><b>Reflectance</b> (type <i>ReflectanceType</i>): A dashed box containing:                     <ul style="list-style-type: none"> <li><b>ID</b> (type <i>xs:string</i>): A simple type element.</li> <li><b>WavelengthCondition</b> (type <i>WavelengthConditionType</i>): A dashed box containing:                             <ul style="list-style-type: none"> <li><b>Values</b> (type <i>UnitlessValuesType</i>): A dashed box containing:                                     <ul style="list-style-type: none"> <li><b>RuleVsDirectional-xy-and-z-Rule</b> (type <i>JEP30-D10:RuleVsDirectional-xy-and-z-RuleType</i>): A dashed box.</li> </ul> </li> </ul> </li> </ul> </li> <li><b>Reflectance-Graph</b> (type <i>Reflectance-GraphType</i>): A dashed box.</li> </ul> </li> </ul>
type	<a href="#">Reflectance-ArrayType</a> , <a href="#">ReflectanceType</a> , <a href="#">WavelengthConditionType</a> , <a href="#">UnitlessValuesType</a> , <a href="#">JEP30-D10:RuleVsDirectional-xy-and-z-RuleType</a> , <a href="#">Reflectance-GraphType</a> .
group	<a href="#">JEP30-D10:ParameterIdentityGroup</a> , <a href="#">JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup</a> , <a href="#">JEP30-D10:RuleGroup</a> .

#### 5.4.3.4.2.1 Reflectance Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical/Reflectance-Array/Reflectance-Graph
diagram	
type	Reflectance-GraphType, JEP30-D10:WavelengthParametricGraphChartX-AxisType, WavelengthUOMType, GraphChartX-AxisFormattingType, JEP30-D10:UnitlessParameterGraphChartY-AxisType, GraphChartY-AxisFormattingType, ReflectanceData-ArrayType, JEP30-D10:WavelengthGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType.
group	AxisParameterIdentityGroup

5.4.3.4.3 Transmission - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical/Transmission-Array
diagram	<p>The diagram illustrates the structure of the Transmission-ArrayType. It is a class that contains a JEP30-D10:ParameterIdentityGroup and a collection of TransmissionType objects (0..∞). The TransmissionType class includes an ID attribute (xs:string) and a collection of WavelengthConditionType objects (0..∞). The WavelengthConditionType class includes a Values attribute (UnitlessValuesType) and a RuleVsDirectional-xy-and-z-Rule association (JEP30-D10:RuleVsDirectional-xy-and-z-RuleType). Additionally, the Transmission-ArrayType class has a collection of Transmission-GraphType objects (0..∞).</p>
type	Transmission-ArrayType, TransmissionType, WavelengthConditionType, UnitlessValuesType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, Transmission-GraphType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup, JEP30-D10:RuleGroup.

5.4.3.4.3.1 Transmission Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Optical/Transmission-Array/Transmission-Graph
diagram	<p>The diagram illustrates the structure of the Transmission-GraphType and its associated types. The main class, Transmission-GraphType, contains several attributes: GraphTitle (xs:string), TestConditionDefinition (JEP30-D10:WavelengthParametricGraphChartX-AxisType), ParameterDefinition (JEP30-D10:UnitlessParameterGraphChartY-AxisType), Data-Array (TransmissionData-ArrayType), GraphFormula (JEP30-D10:GraphMathML-FormulaType), and Formatting (JEP30-D10:GraphFormattingType). The TestConditionDefinition attribute is associated with the JEP30-D10:WavelengthParametricGraphChartX-AxisType, which includes AxisParameterIdentityGroup, WavelengthUOM (WavelengthUOMType), and Formatting (GraphChartX-AxisFormattingType). The ParameterDefinition attribute is associated with the JEP30-D10:UnitlessParameterGraphChartY-AxisType, which includes ID (xs:string), AxisParameterIdentityGroup, and Formatting (GraphChartY-AxisFormattingType). The Data-Array attribute is associated with the TransmissionData-ArrayType, which includes ParameterDefinitionID (xs:string), PlotTestCondition (JEP30-D10:WavelengthGraphPlotConditionType), Data (JEP30-D10:GraphDataType), and Formatting (JEP30-D10:GraphDataFormattingType). The GraphFormula attribute is associated with the JEP30-D10:GraphMathML-FormulaType. The Formatting attribute is associated with the JEP30-D10:GraphFormattingType. The diagram also shows a constraints section at the bottom.</p>
type	Transmission-GraphType, JEP30-D10:WavelengthParametricGraphChartX-AxisType, WavelengthUOMType, GraphChartX-AxisFormattingType, JEP30-D10:UnitlessParameterGraphChartY-AxisType, GraphChartY-AxisFormattingType, TransmissionData-ArrayType, JEP30-D10:WavelengthGraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType.
group	AxisParameterIdentityGroup



### 5.4.3.5 Other Property - Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/OtherProperty-Array
diagram	<p>The diagram illustrates the structure of the MDK-OtherProperty-ArrayType. It is a sequence of MDK-Property elements (0..∞). Each MDK-Property element contains an ID (xs:string), a TestCondition (MDK-TestConditionType, 0..∞), a Values (MDK-PropertyValuesType), a ValueText (xs:string), and a RuleVsDirectional-xy-and-z-Rule (JEP30-D10:RuleVsDirectional-xy-and-z-RuleType). Additionally, there is an MDK-Property-Graph (MDK-Property-GraphType, 0..∞). The entire structure is enclosed in a dashed box labeled MDK-OtherProperty-ArrayType.</p>
type	MDK-OtherProperty-ArrayType, MDK-PropertyType, MDK-TestConditionType, MDK-PropertyValuesType, JEP30-D10:RuleVsDirectional-xy-and-z-RuleType, MDK-Property-GraphType.
group	JEP30-D10:ParameterIdentityGroup.

5.4.3.5.1 Test Condition

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/OtherProperty-Array/MDK-Property/TestCondition
diagram	
type	MDK- TestConditionType, MDK- TestConditionUnitsType, JEP30-D10:FrequencyUOMType, JEP30-D10:Temperature-in-Celsius-or-KelvinUOMType, StrainUOMType, StrainRateUOMType, WavelengthUOMType, JEP30-D10:ComplexUOMType
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup, JEP30-D10:RuleGroup.

### 5.4.3.5.2 Values

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/OtherProperty-Array/MDK-Property/Values
diagram	<pre> classDiagram     class MDK_PropertyValuesType {         +JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup         +MDK-PropertyUnitsType         +BulkConductivity         +BulkResistivity         +CTE         +Density         +FailureStrength         +FieldStrength         +SpecificHeat         +Stress         +ThermalExpansion         +ThermalConductivity         +YieldStrength         +YoungsModulus         +Unitless         +JEP30-D10:ComplexUOMType     }     class MDK_PropertyUnitsType {         +BulkConductivityUOMType         +BulkResistivityUOMType         +CTE         +DensityUOMType         +FailureStrengthUOMType         +FieldStrengthUOMType         +SpecificHeatUOMType         +StressUOMType         +ThermalExpansionUOMType         +ThermalConductivityUOMType         +YieldStrengthUOMType         +YoungsModulusUOMType         +Unitless     }     class JEP30-D10:ComplexUOMType {         +Factor         +UOM     }     class FactorType {         +Prefix         +UOM         +Exponent         +Root     }     class UOMType {         +Prefix         +UOM         +Exponent         +Root     }     MDK_PropertyValuesType --&gt; JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup     MDK_PropertyValuesType --&gt; MDK-PropertyUnitsType     MDK_PropertyValuesType --&gt; BulkConductivity     MDK_PropertyValuesType --&gt; BulkResistivity     MDK_PropertyValuesType --&gt; CTE     MDK_PropertyValuesType --&gt; Density     MDK_PropertyValuesType --&gt; FailureStrength     MDK_PropertyValuesType --&gt; FieldStrength     MDK_PropertyValuesType --&gt; SpecificHeat     MDK_PropertyValuesType --&gt; Stress     MDK_PropertyValuesType --&gt; ThermalExpansion     MDK_PropertyValuesType --&gt; ThermalConductivity     MDK_PropertyValuesType --&gt; YieldStrength     MDK_PropertyValuesType --&gt; YoungsModulus     MDK_PropertyValuesType --&gt; Unitless     MDK_PropertyValuesType --&gt; JEP30-D10:ComplexUOMType     MDK_PropertyUnitsType --&gt; BulkConductivityUOMType     MDK_PropertyUnitsType --&gt; BulkResistivityUOMType     MDK_PropertyUnitsType --&gt; CTE     MDK_PropertyUnitsType --&gt; DensityUOMType     MDK_PropertyUnitsType --&gt; FailureStrengthUOMType     MDK_PropertyUnitsType --&gt; FieldStrengthUOMType     MDK_PropertyUnitsType --&gt; SpecificHeatUOMType     MDK_PropertyUnitsType --&gt; StressUOMType     MDK_PropertyUnitsType --&gt; ThermalExpansionUOMType     MDK_PropertyUnitsType --&gt; ThermalConductivityUOMType     MDK_PropertyUnitsType --&gt; YieldStrengthUOMType     MDK_PropertyUnitsType --&gt; YoungsModulusUOMType     MDK_PropertyUnitsType --&gt; Unitless     JEP30-D10:ComplexUOMType --&gt; Factor     Factor --&gt; UOM     UOM --&gt; Prefix     UOM --&gt; Exponent     UOM --&gt; Root     </pre>
type	MDK-PropertyValuesType, MDK-PropertyUnitsType, BulkConductivityUOMType, BulkResistivityUOMType, JEP30-D10:CTE-UOMType, DensityUOMType, FailureStrengthUOMType, FieldStrengthUOMType, SpecificHeatUOMType, StressUOMType, ThermalExpansionUOMType, ThermalConductivityUOMType, YieldStrengthUOMType, JEP30-D10:YoungsModulus-UOMType, JEP30-D10:EmptyType, JEP30-D10:ComplexUOMType, FactorType, PrefixType, UOMType.
group	JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup.

#### 5.4.3.5.2. Values (cont'd)

The enumerated list of values for each of the UOM's specified above are identified in Table 1.

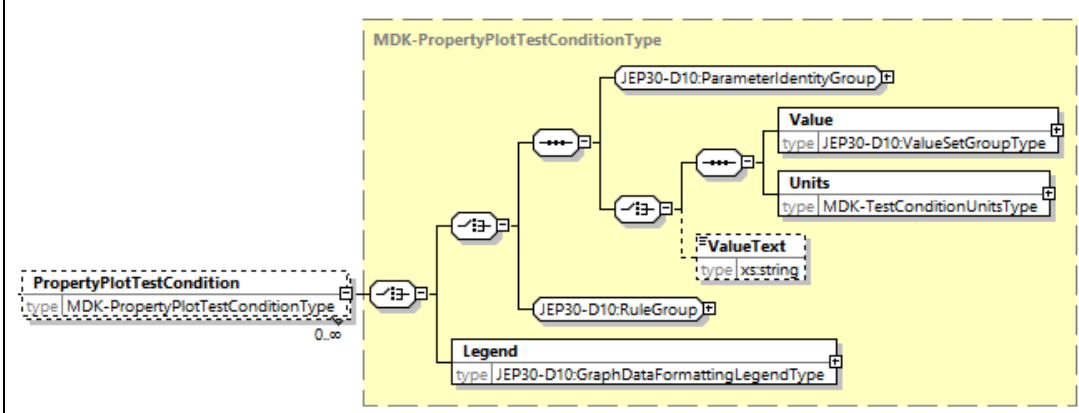
**Table 1 — UOM Enumerated Lists**

Unit	Enumerated Values									
Frequency	Hz	kHz	MHz	GHz						
Temperature	degC	K								
Strain	$\mu\epsilon$ : &#956;&#949;									
StrainRate	$\epsilon$ : &#949;									
Wavelength	nm									
BulkConductivity	S/m									
BulkResistivity	Ohm*m									
CTE	ppm/degC		ppm/K							
Density	kg/m^3	g/cm^3								
FailureStrength	Pa	MPa								
FieldStrength	MV/cm	V/m								
SpecificHeat	J/(g*degC)		J/(g*K)							
Stress	Pa	MPa								
ThermalExpansion	1/DegC	1/K								
ThermalConductivity	W/m.K									
YieldStrength	Pa	MPa								
YoungsModulus	N/m^2	GPa								
ComplexUOM										
- Prefix	Femto	Pico	Nano	Micro	Milli	Unity	Kilo	Mega	Giga	Tera
- UOM	Ampere	Bits	Candela	Celsius	Decibel	Fahrenheit		Farad	Foot	Gram
	Henry	Hertz	Hour	Inch	Kelvin	Least-Significant-Bit			Lumen	
	Meter	Mil	Min	Newton	Ohm	Ounce	Pascal		Percent	
	PartsPerMillion		PartsPerBillion		Pound	Second		Tesla	Volt	Watt

#### 5.4.3.5.3 MDK-Property Graph

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/OtherProperty-Array/MDK-Property-Graph
diagram	<pre> classDiagram     class MDK_Property_GraphType {         GraphTitle xsstring         TestConditionParametricGraphChartX-Axis MDK_TestConditionParametricGraphChartX-AxisType         ParameterDefinition MDK_ParameterDefinitionGraphChartY-AxisType         Data-Array MDK_PropertyData-ArrayType         GraphFormula JEP30-D10:GraphMathML-FormulaType         Formatting JEP30-D10:GraphFormattingType     }     class MDK_TestConditionParametricGraphChartX-AxisType {         Units MDK_TestConditionUnitsType         Formatting JEP30-D10:GraphChartX-AxisFormattingType     }     class MDK_ParameterDefinitionGraphChartY-AxisType {         ID xsstring         Units MDK_PropertyUnitsType         Formatting JEP30-D10:GraphChartY-AxisFormattingType     }     class MDK_PropertyData-ArrayType {         ParameterDefinitionID xsstring         PlotTestCondition MDK_PropertyPlotTestConditionType         Data JEP30-D10:GraphDataType         Formatting JEP30-D10:GraphDataFormattingType     }     MDK_Property_GraphType "1" -- "0..1" MDK_TestConditionParametricGraphChartX-AxisType     MDK_Property_GraphType "1" -- "0..1" MDK_ParameterDefinitionGraphChartY-AxisType     MDK_Property_GraphType "1" -- "0..1" MDK_PropertyData-ArrayType     MDK_Property_GraphType "1" -- "0..1" MDK_PropertyPlotTestConditionType     MDK_Property_GraphType "1" -- "0..1" MDK_PropertyUnitsType     MDK_Property_GraphType "1" -- "0..1" MDK_PropertyData-ArrayType     MDK_Property_GraphType "1" -- "0..1" MDK_PropertyMathML-FormulaType     MDK_Property_GraphType "1" -- "0..1" MDK_PropertyFormattingType     </pre>
type	MDK-Property-GraphType, MDK-TestConditionParametricGraphChartX-AxisType, MDK-TestConditionUnitsType, JEP30-D10:GraphChartX-AxisFormattingType, MDK-ParameterDefinitionGraphChartY-AxisType, MDK-PropertyUnitsType, JEP30-D10:GraphChartY-AxisFormattingType, MDK-PropertyData-ArrayType, MDK-PropertyPlotTestConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType.
group	AxisParameterIdentityGroup

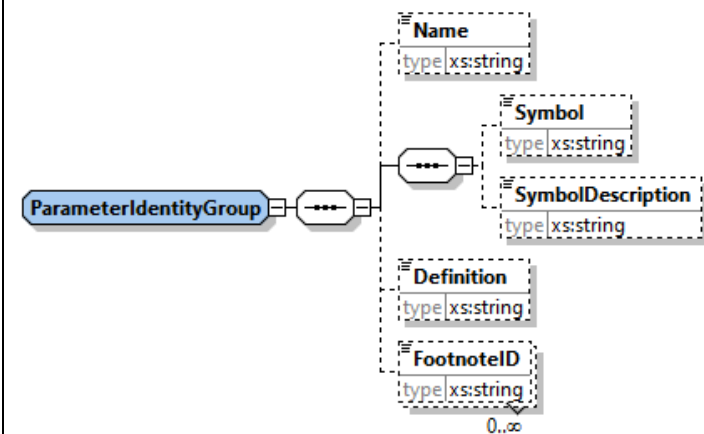
5.4.3.5.4 Property Plot Test Condition

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/OtherProperty-Array/MDK-Property-Graph/Data-Array/PropertyPlotTestCondition
diagram	 <p>The diagram illustrates the structure of the MDK-PropertyPlotTestConditionType. It is a dashed box containing several elements: a 'PropertyPlotTestCondition' element (type MDK-PropertyPlotTestConditionType) with a cardinality of 0..∞; a 'JEP30-D10:ParameterIdentityGroup' element; a 'JEP30-D10:RuleGroup' element; a 'Legend' element (type JEP30-D10:GraphDataFormattingLegendType); and a 'Value' element (type JEP30-D10:ValueSetGroupType) which contains a 'Units' element (type MDK-TestConditionUnitsType) and a 'ValueText' element (type xs:string).</p>
type	MDK-PropertyPlotTestConditionType, JEP30-D10:ValueSetGroupType, MDK-TestConditionUnitsType, JEP30-D10:GraphDataFormattingLegendType.
group	JEP30-D10:ParameterIdentityGroup, JEP30-D10:RuleGroup.

5.4.3.6 Common Structure applied to all Properties

The following sub-sections applies to most Material Properties under each of the Electrical, Thermal, Structural and Optical sections.

5.4.3.6.1 Parameter Identity Group

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/JEP30-D10:ParameterIdentityGroup
diagram	 <p>The diagram illustrates the structure of the ParameterIdentityGroup. It is a dashed box containing several elements: a 'Name' element (type xs:string); a 'Symbol' element (type xs:string); a 'SymbolDescription' element (type xs:string); a 'Definition' element (type xs:string); and a 'FootnoteID' element (type xs:string) with a cardinality of 0..∞.</p>
group	ParameterIdentityGroup

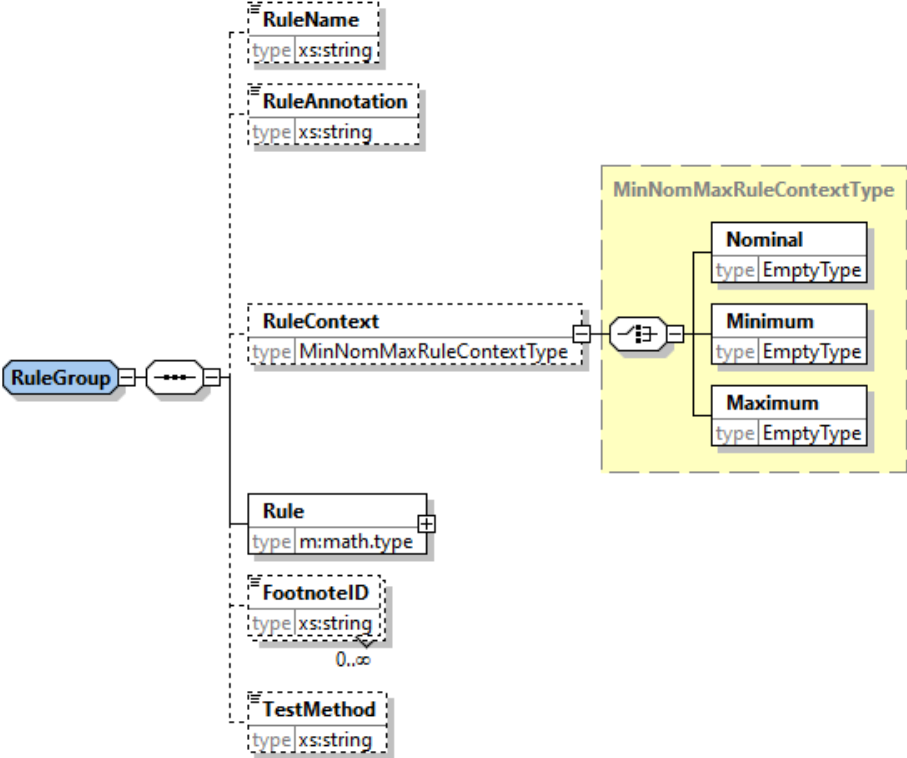
#### 5.4.3.6.2 Value Vs Directional – xy – and – z – Value Group

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../Array/.../JEP30-D10:ValueVsDirectional-xy-and-z-ValueGroup
diagram	
type	ValueSetGroupType
group	ValueVsDirectional-xy-and-z-ValueGroup

#### 5.4.3.6.3 Rule Vs Directional – xy – and – z - Rule

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/DielectricConstant-Array/DielectricConstant/RuleVsDirectional-xy-and-z-Rule
diagram	
type	RuleVsDirectional-xy-and-z-RuleType, JEP30-D10:RuleType, JEP30-D10:xy-DirectionRuleType, JEP30-D10:z-DirectionRuleType
group	RuleGroup

5.4.3.6.3.1 Rule Group

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...Array/.../Jep30-D10: RuleGroup
diagram	 <p>The diagram illustrates the structure of the RuleGroup. A central 'RuleGroup' entity is connected to a dashed box containing several elements: 'RuleName' (type xs:string), 'RuleAnnotation' (type xs:string), 'RuleContext' (type MinNomMaxRuleContextType), 'Rule' (type m:math.type), 'FootnoteID' (type xs:string, 0..∞), and 'TestMethod' (type xs:string). The 'RuleContext' element is further detailed in a yellow box labeled 'MinNomMaxRuleContextType', which contains three sub-elements: 'Nominal' (type EmptyType), 'Minimum' (type EmptyType), and 'Maximum' (type EmptyType).</p>
type	MinNomMaxRuleContextType, EmptyType
group	RuleGroup



#### 5.4.3.6.4 Value Set Group Type

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/...-Array/.../Value</a>
diagram	
type	<a href="#">ValueSetGroupType</a> , <a href="#">ToleranceUOMType</a>
group	<a href="#">ValueSetGroup</a>

#### 5.4.3.6.5 Frequency Condition Type

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/...-Array/.../FrequencyCondition</a>
diagram	
type	<a href="#">JEP30-D10:FrequencyConditionType</a> , <a href="#">ValueSetGroupType</a> , <a href="#">FrequencyUOMType</a> .
group	<a href="#">ParameterIdentityGroup</a> .

The enumerated values for [FrequencyUOM](#) are Hz, KHz, MHz, GHz, and sqrtHz

5.4.3.6.6 Temperature Condition Type

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/.../TemperatureCondition
diagram	
type	JEP30-D10:TemperatureConditionType, ValueSetGroupType, Temperature-in-Celsius-or-KelvinUOMType.
group	ParameterIdentityGroup

The enumerated values for *Temperature-in-Celsius-or-KelvinUOMType* are DegC and K

5.4.3.6.7 Temp-or-Freq Test Condition Units Type

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/TestConditionDefinition/Units
diagram	
type	Temp-or-FreqTestConditionUnitsType, FrequencyUOMType, Temperature-in-Celsius-or-KelvinUOMType.

5.4.3.6.8 Axis Parameter Identity Group

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/...-Array/...-Graph/TestConditionDefinition
diagram	<p>The diagram shows the <b>AxisParameterIdentityGroup</b> class with the following attributes:</p> <ul style="list-style-type: none"><li><b>AxisTitle</b>: type xs:string</li><li><b>Name</b>: type xs:string</li><li><b>Symbol</b>: type xs:string</li><li><b>SymbolDescription</b>: type xs:string</li><li><b>Definition</b>: type xs:string</li><li><b>FootnoteID</b>: type xs:string (multiplicity 0..∞)</li></ul> <p>The class is connected to a sequence of three dashed boxes, each containing a multiplicity of 0..∞.</p>
group	AxisParameterIdentityGroup

#### 5.4.3.6.9 Graph Structure applicable to Material Properties

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Electrical/...-Array/...-Graph
diagram	
type	<p>...-GraphType, JEP30-D10:...ParametricGraphChartX-AxisType, ...UOMType, GraphChartX-AxisFormattingType, ...ParameterGraphChartY-AxisType, JEP30-D10:GraphChartY-AxisFormattingType, ...Data-ArrayType, JEP30-D10:GraphMathML-FormulaType, JEP30-D10:GraphFormattingType.</p>
group	AxisParameterIdentityGroup, JEP30-D10:AxisParameterIdentityGroup,

A **...Graph** has 2 axis that are defined by the **TestConditionType** (The X-axis definition), and the **ParameterType** (The Y-axis definition). Each axis is labelled by the **AxisTitle**. When possible, the **Symbol** which represents the **AxisTitle** should be added to the PartModel file and should represent a standards-based symbol as defined in the appropriate Terms and Definitions standards. If appropriate, a more detailed **Description** can be used to describe the definition of the **AxisTitle**. Each axis will also have a pre-defined set of **Units** but can be optionally excluded for those axis' which are unitless.

Note that the **ParameterDefinition** is unbounded whereas the **TestConditionDefinition** is bounded to a single instance. This is to cater for those graphs in which there are 2 or more y-axis, each with their own definition.

The graph can either be captured under the **Data-Array** or represented via a **GraphFormula** (A string representing the equation of the **ParameterDefinition** relationship to the **TestConditionDefinition**).

#### 5.4.3.6.9.1 Graph Chart X Axis Formatting Type

The Formatting is an optional set of data that enables the user to re-create the graph for visualization purposes. Formatting applies to the following

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/TestConditionDefinition/Formatting
diagram	<pre> classDiagram     class GraphChartXAxisFormattingType {         Range         Inverted         Scale         Position     }     class GraphAxisRangeType {         Minimum         Maximum     }     class GraphAxisScaleType {         Linear         Logarithmic     }     class GraphAxisScaleLinearType {         Step     }     class GraphAxisScaleLogarithmicType {         Natural         Base     }     class GraphChartXAxisPositionType      GraphChartXAxisFormattingType "1" -- "*" GraphAxisRangeType : Range     GraphChartXAxisFormattingType "1" -- "*" EmptyType : Inverted     GraphChartXAxisFormattingType "1" -- "*" GraphAxisScaleType : Scale     GraphChartXAxisFormattingType "1" -- "*" GraphChartXAxisPositionType : Position     GraphAxisRangeType "1" -- "*" xs:int : Minimum     GraphAxisRangeType "1" -- "*" xs:int : Maximum     GraphAxisScaleType "1" -- "*" GraphAxisScaleLinearType : Linear     GraphAxisScaleType "1" -- "*" GraphAxisScaleLogarithmicType : Logarithmic     GraphAxisScaleLinearType "1" -- "*" xs:float : Step     GraphAxisScaleLogarithmicType "1" -- "*" xs:string : Natural     GraphAxisScaleLogarithmicType "1" -- "*" xs:float : Base     </pre>
type	GraphChartXAxisFormattingType, GraphAxisRangeType, EmptyType, GraphAxisScaleType, GraphAxisScaleLinearType, GraphAxisScaleLogarithmicType, GraphChartXAxisPositionType.

#### 5.4.3.6.9.2 Graph Chart Y Axis Formatting Type

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/ParameterDefinition/Formatting</a>
diagram	<pre> classDiagram     class Formatting["Formatting (type GraphChartYAxisFormattingType)"]     class Range["Range (type GraphAxisRangeType)"]     class Inverted["Inverted (type EmptyType)"]     class Scale["Scale (type GraphAxisScaleType)"]     class Linear["Linear (type GraphAxisScaleLinearType)"]     class Logarithmic["Logarithmic (type GraphAxisScaleLogarithmicType)"]     class Step["Step (type xs:float)"]     class Natural["Natural (type xs:string)"]     class Base["Base (type xs:float, default 10.0)"]     class Position["Position (type GraphChartYAxisPositionType)"]      Formatting --&gt; Range     Formatting --&gt; Inverted     Formatting --&gt; Scale     Range --&gt; Minimum["Minimum (type xs:int)"]     Range --&gt; Maximum["Maximum (type xs:int)"]     Scale --&gt; Linear     Scale --&gt; Logarithmic     Linear --&gt; Step     Logarithmic --&gt; Natural     Logarithmic --&gt; Base     Position --- Formatting     </pre>
type	<a href="#">GraphChartYAxisFormattingType</a> , <a href="#">GraphAxisRangeType</a> , <a href="#">EmptyType</a> , <a href="#">GraphAxisScaleType</a> , <a href="#">GraphAxisScaleLinearType</a> , <a href="#">GraphAxisScaleLogarithmicType</a> , <a href="#">GraphChartYAxisPositionType</a> .

The axis range which is usually defined from minimum to maximum can be inverted to show a graph going from maximum to minimum. The scale can be defined in either a linear step amount, a natural logarithm, or a logarithm of the specified base. The [Base](#) log is set to a default of [Base 10](#) but can be defined to any base number.

The [Position](#) enumerated list for the [GraphChartXAxisPositionType](#) is

- Top
- Bottom

And for the [GraphChartYAxisPositionType](#), the enumerated values are

- Left
- Right

### 5.4.3.6.9.3 Graph Formatting Type

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/...-Array/...-Graph/Formatting</a>
diagram	<pre> classDiagram     class GraphFormattingType {         +DisplayType         +Legend     }     class DisplayType {         +type GraphDisplayType     }     class Legend {         +type GraphLegendType     }     class GraphLegendType {         +Location type GraphLegendLocationType         +VerticalPosition type GraphLegendVerticalPositionType         +HorizontalPosition type GraphLegendHorizontalPositionType     }     GraphFormattingType --&gt; DisplayType     GraphFormattingType --&gt; Legend     Legend --&gt; GraphLegendType     </pre>
type	<a href="#">GraphFormattingType</a> , <a href="#">GraphDisplayType</a> , <a href="#">GraphLegendType</a> , <a href="#">GraphLegendLocationType</a> , <a href="#">GraphLegendVerticalPositionType</a> , <a href="#">GraphLegendHorizontalPositionType</a> .

The body of the graph can be formatted under the [GraphFormattingType](#). The [DisplayType](#) enumerated list is

- Line
- Bar

The graph Legend can also be positioned around the graph in any of the following locations:

- Location
  - Inside Graph,
  - Outside Graph,
- Vertical Position
  - Top,
  - Center,
  - Bottom,
- Horizontal Position
  - Left,
  - Center,
  - Right.

#### 5.4.3.6.9.4 Linking the Data-Array to the Appropriate Parameter Definition

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph
diagram	<p>The diagram illustrates the XML Schema for BulkConductivity-GraphType. It shows a hierarchy of elements and types. The main type is BulkConductivity-GraphType, which contains elements like GraphTitle, TestConditionDefinition, ParameterDefinition, Data-Array, GraphFormula, and Formatting. The ParameterDefinition element is linked to BulkConductivityParameterGraphChartY-AxisType, which in turn is linked to BulkConductivityUOM. The Data-Array element is linked to BulkConductivityData-ArrayType, which contains elements like ParameterDefinitionID, PlotTestCondition, Data, and Formatting. A red circle highlights the relationship between the BulkConductivityUOM and the BulkConductivityData-ArrayType.</p>
type	...GraphType, ...ParametricGraphChartXAxisType, ...ParameterGraphChartYAxisType, ...UOMType, JEP30-D10:GraphChartYAxisFormattingType, ...Data-ArrayType, ...GraphPlotConditionType, JEP30-D10:GraphDataType, JEP30-D10:GraphDataFormattingType, JEP30-D10:GraphFormattingType,
group	JEP30-D10:AxisParameterIdentityGroup

When populating the [Data-Array](#) for a given graph, the set of data is referenced to the specific [ParameterDefinition](#) via the [ParameterDefinitionID](#). The process is replicated for each [ParameterDefinition](#) if there are 2 or more vertical [ParameterDefinition](#) axis defined. Each set of data captured under the [Data-Array](#) is now tied to the appropriate [ParameterDefinition](#) axis. The data plot on the graph, is a set of points associated with the intersection of these two axis and can be either captured under the [Data-Array](#) or represented via a [GraphFormula](#).

A rule may also be defined as a function on one parameter against a second test condition parameter.



#### 5.4.3.6.9.5 Data-Array

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/Data-Array
diagram	
type	...Data-ArrayType, JEP30-D10:...GraphPlotConditionType, JEP30-D10:GraphDataType, MinNomMaxValueSetType, JEP30-D10:GraphDataFormattingType.

Each *Data* set consisting of the *TestConditionValue*, and the *ParameterValue* represents one point of the data plot on the graph. Various examples of Parameter Graphs are shown below, and representation of those parameter graph examples accompany each graph.

#### 5.4.3.6.9.6 Graph Formula

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/...-Array/...-Graph/GraphFormula
diagram	<pre> classDiagram     class GraphFormula {         RuleName type xs:string         RuleAnnotation type xs:string         RuleContext type MinNomMaxRuleContextType         Rule type m:math.type     }     class JEP30-D10-GraphMathML-FormulaType {         RuleName type xs:string         RuleAnnotation type xs:string         RuleContext type MinNomMaxRuleContextType         Rule type m:math.type         FootnoteID type xs:string         TestMethod type xs:string     }     GraphFormula "1" -- "1..∞" JEP30-D10-GraphMathML-FormulaType     </pre>
type	JEP30-D10:GraphMathML-FormulaType, MinNomMaxRuleContextType, m:math.type.

#### 5.4.3.6.9.7 Temp-or-Freq Plot Test Condition Type

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/Data-Array/PlotTestCondition
diagram	
type	Temp-or-FreqPlotTestConditionType, ValueSetGroupType, Temp-or-FreqTestConditionUnitsType, GraphDataFormattingLegendType.
group	ParameterIdentityGroup, RuleGroup.

#### 5.4.3.6.9.8 Temperature Graph Plot Test Condition Type

path	PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/Data-Array/PlotTestCondition
diagram	
type	JEP30-D10:TemperatureGraphPlotConditionType, ValueSetGroupType, Temperature-in-Celsius-or-KelvinUOMType, GraphDataFormattingLegendType
group	ParameterIdentityGroup, RuleGroup.

Depending upon the type of test condition, its value may be a string or label that describes the [PlotTestCondition](#), in which case the value is populated under the [Legend](#) branch. If, however, the [PlotTestCondition](#) can be represented by a [Symbol](#) or a [Rule](#), then this should be written to the top branch under the [PlotTestCondition](#) as opposed to the [Legend](#) branch as a string. The [Symbol](#) should represent a standards-based symbol as defined in the appropriate Terms and Definitions standards. If appropriate, a more detailed [SymbolDescription](#) can be defined to describe the definition of the [PlotTestCondition](#). The [Symbol](#) can have a pre-defined set of [Units](#) but can be optionally excluded for those [PlotTestCondition](#) which are unitless.

### 5.4.3.6.9.9 Graph Data Formatting Type

path	<a href="#">PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/.../...-Array/...-Graph/Data-Array/Formatting.</a>
diagram	<pre> graph LR     GDF[GraphDataFormattingType] --&gt; P[Point]     GDF --&gt; L[Line]     P --&gt; PC[Color]     P --&gt; PS[Style]     L --&gt; LC[Color]     L --&gt; LS[Style]     </pre>
type	<a href="#">GraphDataFormattingType</a> , <a href="#">GraphDataFormattingPointType</a> , <a href="#">GraphDataFormattingLineType</a> , <a href="#">GraphDataFormattingColorType</a> , <a href="#">GraphDataFormattingPointStyleType</a> , <a href="#">GraphDataFormattingLineStyleType</a> .

The data points can also be formatted. Individual data points can have the following styles

- Point Styles are
  - Circle,
  - Square,
  - Triangle,
  - None.
- Line Style are
  - Solid,
  - Dash,
  - Dot,
  - Dash-dot,
  - Dash-dash-dot,
  - None.
- Colors are
  - Red,
  - Green,
  - Blue,
  - Orange,
  - Brown,
  - Pink,
  - Purple,
  - Yellow,
  - Black.

The xml fragment shown below represents the data plotted in Figure 44 — Capacitance Value versus Temperature.

#### 5.4.3.6.9.10 Example of a Stress vs Strain Graph

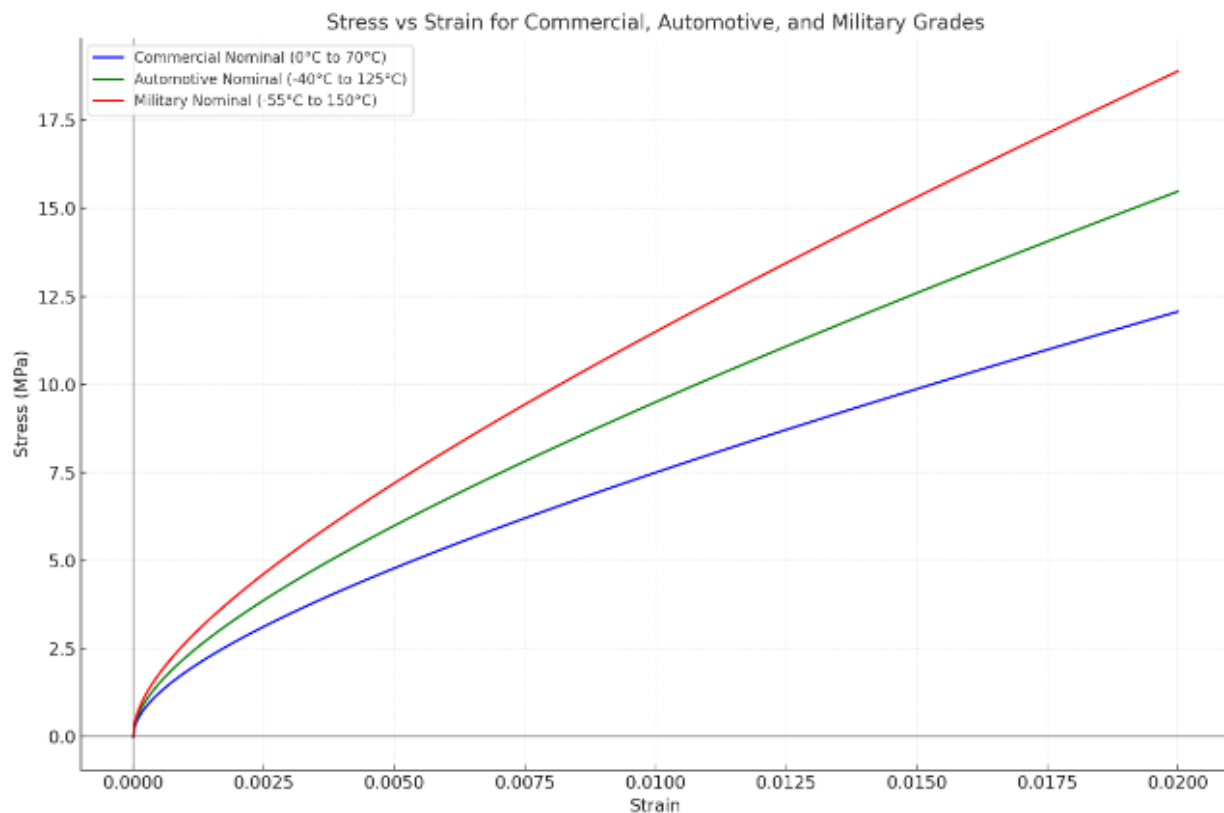


Figure 1 – Stress vs Strain

Below is an example of a Stress versus Strain graph in xml. The XML data would be located under the following path.

PartModel/DesignKitSection/MaterialDesignKit-Array/MaterialDesignKit/Structural/Stress-Array

```
<Stress-Array>
  <GraphTitle>Capacitance Value versus Temperature</GraphTitle>
  <TestConditionDefinition>
    <AxisTitle>Strain</AxisTitle>
    <Name>Strain</Name>
    <Symbol>ε</Symbol>
    <Definition> Strain is the relative change in length: ε = ΔL/L</Definition>
    <Units>
      <StrainUOM>ε</StrainUOM>
    </Units>
    <Formatting>
      <Range>
        <Minimum>0.0000</Minimum>
        <Maximum>0.0200</Maximum>
      </Range>
    </Formatting>
  </TestConditionDefinition>
  <StressData>
    <Strain>0.0000</Strain>
    <Stress>0.00</Stress>
    <Strain>0.0025</Strain>
    <Stress>2.50</Stress>
    <Strain>0.0050</Strain>
    <Stress>4.50</Stress>
    <Strain>0.0075</Strain>
    <Stress>6.50</Stress>
    <Strain>0.0100</Strain>
    <Stress>8.50</Stress>
    <Strain>0.0125</Strain>
    <Stress>10.50</Stress>
    <Strain>0.0150</Strain>
    <Stress>12.50</Stress>
    <Strain>0.0175</Strain>
    <Stress>14.50</Stress>
    <Strain>0.0200</Strain>
    <Stress>16.50</Stress>
  </StressData>
</Stress-Array>
```

#### 5.4.3.6.9.9 Example of a Stress vs Strain Graph (cont'd)

```

        <Scale>
            <Linear>
                <Step>0.0025</Step>
            </Linear>
        </Scale>
        <Position>Bottom</ Position >
    </Formatting>
</TestConditionDefinition>
<ParameterDefinition>
    <ID>Parameter Axis ID 1</ID >
    <AxisTitle>Stress (MPa)</AxisTitle>
    <Symbol>&#963;</Symbol>
    <Definition>Stress is defined as force per unit area: &#963; = F/A.</Definition>
    <StressUOM>
        <MPa>
    </StressUOM>
    <Formatting>
        <Range>
            <Minimum>0.0</Minimum>
            <Maximum>17.5</Maximum>
        </Range >
        <Scale>
            <Linear>
                <Step>2.5</Step>
            </Linear>
        </Scale>
        <Position>Left</ Position >
    </Formatting >
</ParameterType>
<Data-Array>
    <ParameterDefinitionID>Parameter Axis ID 1</ParameterDefinitionID>
    <_PlotConditionDefinition>
        <Legend>
            <Title>Commercial </Title >
            <Description>Commercial Nominal (0&deg;C to 70
&deg;C).</Description>
        </Legend>
    </PlotConditionDefinition>
    <Data>
        <TestConditionValue>0.0000</TestConditionValue>
        <ParameterValue>
            <Nominal>0.0000</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        <TestConditionValue>0.0025</TestConditionValue>
        <ParameterValue>
            <Nominal>3.125</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        <TestConditionValue>0.0050</TestConditionValue>
        <ParameterValue>
            <Nominal>4.786</Nominal>

```

#### 5.4.3.6.9.9 Example of a Stress vs Strain Graph (cont'd)

```

        </ParameterValue>
    </Data>
    <Data>
        :
    </Data>
    <Formatting>
        <Line>
            <Color>Blue</Color>
            < Style>Solid</Style>
        </ Line>
    </Formatting>
</Data-Array>
<Data-Array>
    <ParameterDefinitionID>Parameter Axis ID 1</ParameterDefinitionID>
    <_PlotConditionDefinition>
        <Legend>
            <Title>Automotive</Title >
            <Description>Automotive Nominal (-40&#176;C to
125&#176;C).</Description>
        </Legend>
    </PlotConditionDefinition>
    <Data>
        <TestConditionValue>0.0000</TestConditionValue>
        <ParameterValue>
            <Nominal>0.0000</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        <TestConditionValue>0.0025</TestConditionValue>
        <ParameterValue>
            <Nominal>3.875</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        <TestConditionValue>0.0050</TestConditionValue>
        <ParameterValue>
            <Nominal>5.993</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        :
    </Data>
    <Formatting>
        <Line>
            <Color>Green</Color>
            < Style>Solid</Style>
        </ Line>
    </Formatting>
</Data-Array>
<Data-Array>
    <ParameterDefinitionID>Parameter Axis ID 1</ParameterDefinitionID>
    <_PlotConditionDefinition>
        <Legend>
            <Title>Military</Title >

```

#### 5.4.3.6.9.9 Example of a Stress vs Strain Graph (cont'd)

```

        <Description>Military Nominal (-55&#176;C to
155&#176;C).</Description>
        </Legend>
    </PlotConditionDefinition>
    <Data>
        <TestConditionValue>0.0000</TestConditionValue>
        <ParameterValue>
            <Nominal>0.0000</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        <TestConditionValue>0.0025</TestConditionValue>
        <ParameterValue>
            <Nominal>4.625</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        <TestConditionValue>0.0050</TestConditionValue>
        <ParameterValue>
            <Nominal>7.200</Nominal>
        </ParameterValue>
    </Data>
    <Data>
        :
    </Data>
    <Formatting>
        <Line>
            <Color>Red</Color>
            <Style>Solid</Style>
        </Line>
    </Formatting>
</Data-Array>
<Formatting>
    <DisplayType>Line</DisplayType>
    <Legend>
        <Location>Line</Location>
        <VerticalPosition>Top</VerticalPosition>
        <HorizontalPosition>Left</HorizontalPosition>
    </Legend>
</Formatting>
</ParameterGraph>

```

## 5.5 Package Test Design Kit - Array

path	<a href="#">PartModel/DesignKitSection/PackageTestDesignKit-Array</a>
diagram	<p>The diagram illustrates the XML Schema (XSD) structure for the <code>PackageTestDesignKit-Array</code>. It shows a sequence of elements: <code>PackageTestDesignKit-ArrayType</code> (containing <code>PackageTestDesignKit</code>), followed by <code>PackageTestDesignKit</code> (containing <code>ID</code>, <code>Footnote-Array</code>, <code>DocumentID</code>, and <code>PackageTestDesignKitSignature</code>). The <code>PackageTestDesignKit</code> element is repeated 1 to infinity times. The <code>Footnote-Array</code> element is of type <code>JEP30-D10:Footnote-ArrayType</code>. The <code>DocumentID</code> element is of type <code>xs:string</code>. The <code>PackageTestDesignKitSignature</code> element is of type <code>ds:SignatureType</code>. A <code>constraints</code> box is also present.</p>
type	<a href="#">PackageTestDesignKit-ArrayType</a> , <a href="#">PackageTestDesignKitType</a> , <a href="#">JEP30-D10:Footnote-ArrayType</a> , <a href="#">ds:SignatureType</a>

This section will be developed in a future release of this document. The structure currently acts as a placeholder for the [PackageTestDesignKit](#).



## 5.6 Footprint Rule Design Kit - Array

path	<b>PartModel/DesignKitSection/FootprintRuleDesignKit-Array</b>
diagram	
type	<b>FootprintRuleDesignKit-ArrayType, FootprintRuleDesignKitType, Terminal-to-PadRule-ArrayType, FootprintRules-ArrayType, JEP30-D10:Footnote-ArrayType, ds:SignatureType</b>

### 5.6.1 Terminal – to – Pad Rule - Array

path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/Terminal-to-PadRule-Array</a>
diagram	
type	<a href="#">Terminal-to-PadRule-ArrayType</a> , <a href="#">Terminal-to-PadRuleType</a> , <a href="#">TableHeaderType</a> , <a href="#">TableRowLabelType</a> , <a href="#">TableDataType</a>

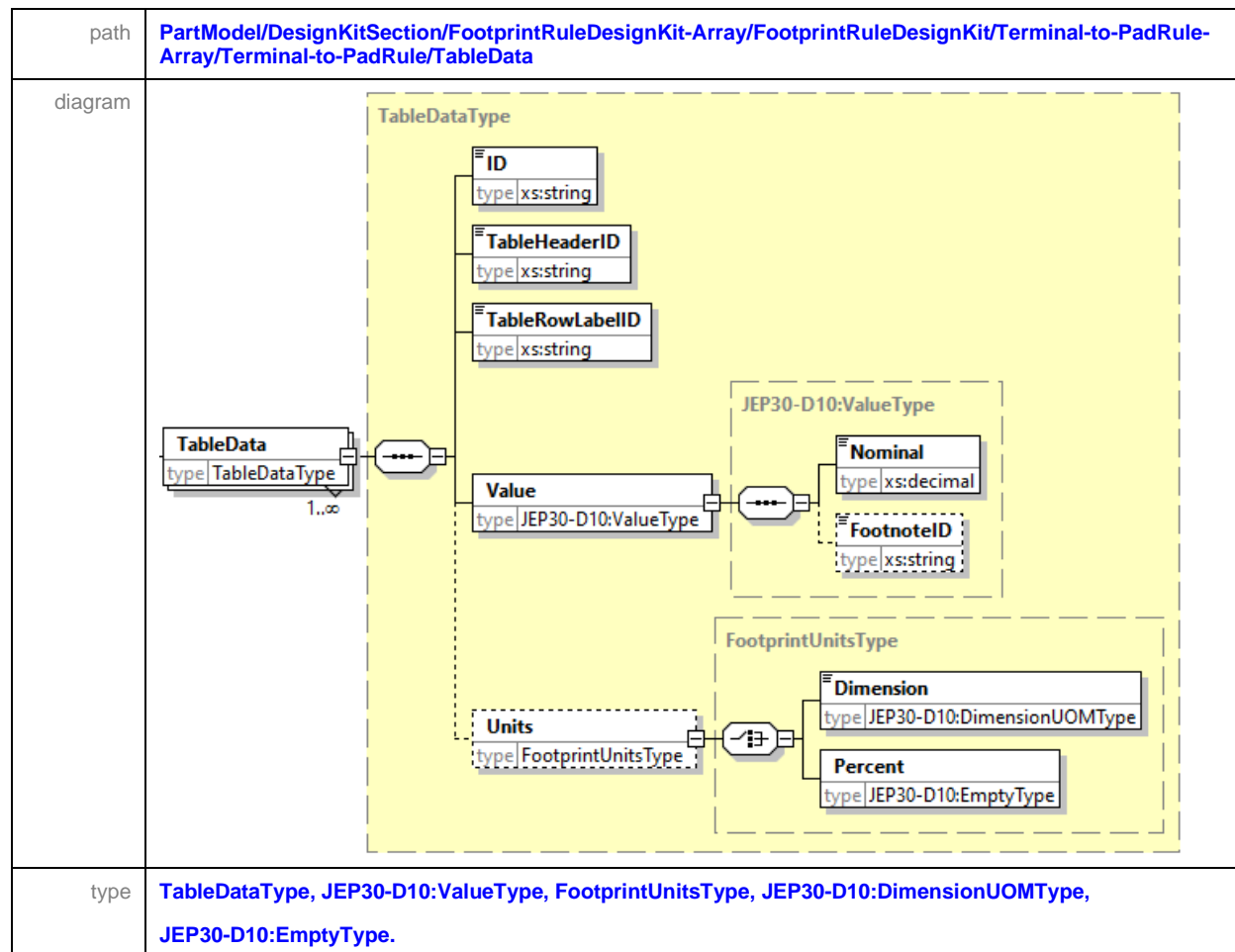
#### 5.6.1.1 Table Header

path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/Terminal-to-PadRule-Array/Terminal-to-PadRule/TableHeader</a>
diagram	
type	<a href="#">TableHeaderType</a> , <a href="#">TableRowLabelType</a> , <a href="#">TableDataType</a>

### 5.6.1.2 Table Row Label

path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/Terminal-to-PadRule-Array/Terminal-to-PadRule/TableRowLabel</a>
diagram	<p>The diagram illustrates the XSD structure for the <code>TableRowLabelType</code>. It is a complex type containing the following elements:</p> <ul style="list-style-type: none"> <li><b>ID</b>: type <code>xs:string</code></li> <li><b>Name</b>: type <code>xs:string</code></li> <li><b>RowIndex</b>: type <code>xs:integer</code>, with <code>derivedBy</code> set to <code>restriction</code> and <code>minIncl/maxIncl</code> set to <code>1</code>.</li> <li><b>Description</b>: type <code>xs:string</code></li> <li><b>FootnoteID</b>: type <code>xs:string</code></li> </ul> <p>A separate element <code>TableRowLabel</code> is shown with type <code>TableRowLabelType</code> and a cardinality of <code>0..∞</code>.</p>
type	<a href="#">TableRowLabelType</a>

### 5.6.1.3 Table Data



The following is a xml sample of the table structure for Ball Grid Array components as defined in IPC-7352 Generic Guideline for Land Pattern Design.

**Table 2 — Ball Grid Array Components (unit: mm)**

Terminal	Maximum (Most) Density Level A	Median (Nominal) Density Level B	Minimum (Least) Density Level C
Periphery Collapsing Ball	25% reduction below nominal ball diameter	20% reduction below nominal ball diameter	15% reduction below nominal ball diameter
Periphery Non-Collapsing Ball or Column	15% increase above the nominal ball or column diameter	10% increase above the nominal ball or column diameter	5% increase above the nominal ball or column diameter
Round-off factor	Round off to the nearest two place decimal, i.e., 1.00, 1.05, 1.10, 1.15		
Courtyard excess	2.00	1.00	0.50
Ball Grid Array BGA Construction and land pattern development are described in 14.1.1 and 14.1.2			

### 5.6.1.3 Table Data (cont'd)

```

<Terminal-to-PadRule-Array>
  <Terminal-to-PadRule>
    <ID>Terminal-to-PadRule 1</ID>
    <Name>Table 3-17</Name>
    <Description>Ball Grid Array Components</Description>
    <TableHeader>
      <ID>Table Header 1</ID>
      <Name>Maximum</Name>
      <Description>Maximum (Most) Density Level A</Description>
    </TableHeader>
    <TableHeader>
      <ID>Table Header 2</ID>
      <Name>Median</Name>
      <Description>Median (Nominal) Density Level B</Description>
    </TableHeader>
    <TableHeader>
      <ID>Table Header 3</ID>
      <Name>Minimum</Name>
      <Description>Minimum (Least) Density Level C</Description>
    </TableHeader>
    <TableRowLabel>
      <ID>Table Row Label 1</ID>
      <Name>Periphery Collapsing Ball</Name>
      <FootnoteID>Footnote 2</FootnoteID>
    </TableRowLabel>
    <TableRowLabel>
      <ID>Table Row Label 2</ID>
      <Name>Periphery Non-Collapsing Ball or Column</Name>
      <FootnoteID>Footnote 3</FootnoteID>
    </TableRowLabel>
    <TableRowLabel>
      <ID>Table Row Label 3</ID>
      <Name>Round-off factor</Name>
      <FootnoteID>Footnote 4</FootnoteID>
    </TableRowLabel>
    <TableRowLabel>
      <ID>Table Row Label 4</ID>
      <Name>Courtyard excess</Name>
    </TableRowLabel>
    <TableData>
      <ID>Table Data 1</ID>
      <TableHeaderID>Table Header 1</TableHeaderID>
      <TableRowLabelID>Table Row Label 1</TableRowLabelID>
      <Value>
        <Nominal>-25</Nominal>
      </Value>
      <Units>
        <Percent/>
      </Units>
    </TableData>
    <TableData>
      <ID>Table Data 2</ID>
      <TableHeaderID>Table Header 1</TableHeaderID>

```

### 5.6.1.3 Table Data (cont'd)

```

        <TableRowLabelID>Table Row Label 2</TableRowLabelID>
        <Value>
            <Nominal>15</Nominal>
        </Value>
        <Units>
            <Percent/>
        </Units>
    </TableData>
</TableData>
<TableData>
    <ID>Table Data 3</ID>
    <TableHeaderID>Table Header 1</TableHeaderID>
    <TableRowLabelID>Table Row Label 3</TableRowLabelID>
    <Value>
        <Nominal>0.01</Nominal>
    </Value>
</TableData>
<TableData>
    <ID>Table Data 4</ID>
    <TableHeaderID>Table Header 1</TableHeaderID>
    <TableRowLabelID>Table Row Label 4</TableRowLabelID>
    <Value>
        <Nominal>2.00</Nominal>
    </Value>
    <Units>
        <Dimension>mm</Dimension>
    </Units>
</TableData>
<TableData>
    <ID>Table Data 5</ID>
    <TableHeaderID>Table Header 2</TableHeaderID>
    <TableRowLabelID>Table Row Label 1</TableRowLabelID>
    <Value>
        <Nominal>-20</Nominal>
    </Value>
    <Units>
        <Percent/>
    </Units>
</TableData>
<TableData>
    <ID>Table Data 6</ID>
    <TableHeaderID>Table Header 2</TableHeaderID>
    <TableRowLabelID>Table Row Label 2</TableRowLabelID>
    <Value>
        <Nominal>10</Nominal>
    </Value>
    <Units>
        <Percent/>
    </Units>
</TableData>
<TableData>
    <ID>Table Data 7</ID>
    <TableHeaderID>Table Header 2</TableHeaderID>
    <TableRowLabelID>Table Row Label 3</TableRowLabelID>

```

### 5.6.1.3 Table Data (cont'd)

```

        <Value>
            <Nominal>0.01</Nominal>
        </Value>
    </TableData>
    <TableData>
        <ID>Table Data 8</ID>
        <TableHeaderID>Table Header 2</TableHeaderID>
        <TableRowLabelID>Table Row Label 4</TableRowLabelID>
        <Value>
            <Nominal>1.0</Nominal>
        </Value>
        <Units>
            <Dimension>mm</Dimension>
        </Units>
    </TableData>
    <TableData>
        <ID>Table Data 9</ID>
        <TableHeaderID>Table Header 3</TableHeaderID>
        <TableRowLabelID>Table Row Label 1</TableRowLabelID>
        <Value>
            <Nominal>-15</Nominal>
        </Value>
        <Units>
            <Percent/>
        </Units>
    </TableData>
    <TableData>
        <ID>Table Data 10</ID>
        <TableHeaderID>Table Header 3</TableHeaderID>
        <TableRowLabelID>Table Row Label 2</TableRowLabelID>
        <Value>
            <Nominal>5</Nominal>
        </Value>
        <Units>
            <Percent/>
        </Units>
    </TableData>
    <TableData>
        <ID>Table Data 11</ID>
        <TableHeaderID>Table Header 3</TableHeaderID>
        <TableRowLabelID>Table Row Label 3</TableRowLabelID>
        <Value>
            <Nominal>0.01</Nominal>
        </Value>
    </TableData>
    <TableData>
        <ID>Table Data 12</ID>
        <TableHeaderID>Table Header 3</TableHeaderID>
        <TableRowLabelID>Table Row Label 4</TableRowLabelID>
        <Value>
            <Nominal>0.50</Nominal>
        </Value>
        <Units>

```

### 5.6.1.3 Table Data (cont'd)

```

        <Dimension>mm</Dimension>
    </Units>
</TableData>
    <FootnoteID>Footnote 4</FootnoteID>
</Terminal-to-PadRule>
</Terminal-to-PadRule-Array>

:
<Footnote-Array>
    <Footnote>
        <ID>Footnote 1</ID>
        <Footnote>Ball Grid Array BGA Construction and land pattern development
are described in 14.1.1 & 14.1.2</Footnote>
    </Footnote>
    <Footnote>
        <ID>Footnote 2</ID>
        <Footnote>reduction below nominal ball diameter</Footnote>
    </Footnote>
    <Footnote>
        <ID>Footnote 3</ID>
        <Footnote>increase above the nominal ball or column diameter</Footnote>
    </Footnote>
    <Footnote>
        <ID>Footnote 4</ID>
        <Footnote>Round off to the nearest two place decimal, i.e., 1.00, 1.05,
1.10, 1.15</Footnote>
    </Footnote>
</Footnote-Array>

```



## 5.6.2 Footprint Rules - Array

path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/FootprintRules-Array</a>
diagram	<p>The diagram illustrates the structure of the <b>FootprintRules-Array</b> type. It is an array of <b>FootprintRule</b> elements. Each <b>FootprintRule</b> element contains an <b>ID</b> (xs:string), an <b>Output-Array</b> (RuleOutput-ArrayType), a <b>Condition-Array</b> (FootprintRulesCondition-ArrayType), and an <b>IntermediaryRuleValue-Array</b> (IntermediaryRuleValue-ArrayType). The <b>Condition-Array</b> contains <b>Condition</b> (ExpressionConditionType) and <b>ConditionSet</b> (ExpressionConditionSetType) elements.</p>
type	<a href="#">FootprintRules-ArrayType</a> , <a href="#">FootprintRulesCondition-ArrayType</a> , <a href="#">ExpressionConditionType</a> , <a href="#">ExpressionConditionSetType</a> , <a href="#">FootprintRuleType</a> , <a href="#">RuleOutput-ArrayType</a> , <a href="#">IntermediaryRuleValue-ArrayType</a>

5.6.2.1 Condition

path	PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/FootprintRules-Array/Condition-Array/Condition
diagram	
type	ExpressionConditionType, ExpressionTokenType, FunctionType, JEP30-D10:EmptyType.

### 5.6.2.2 Condition Set

path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/FootprintRules-Array/Condition-Array/ConditionSet</a>
diagram	<p>The diagram illustrates the structure of the <b>ConditionSet</b> element. It is defined with the type <b>ExpressionConditionSetType</b> and a cardinality of <b>1..∞</b>. The structure is as follows:</p> <ul style="list-style-type: none"> <li><b>ConditionSet</b> (type <b>ExpressionConditionSetType</b>, 1..∞)       <ul style="list-style-type: none"> <li><b>ID</b> (type <b>xs:string</b>)</li> <li>Choice of:           <ul style="list-style-type: none"> <li><b>Operator</b> (type <b>OperatorType</b>)</li> <li>Choice of:               <ul style="list-style-type: none"> <li><b>ConditionID</b> (type <b>xs:string</b>)</li> <li><b>ConditionSetID</b> (type <b>xs:string</b>)</li> </ul> </li> </ul> </li> <li><b>EvaluatedAs</b> (type <b>xs:boolean</b>, 0..∞)</li> <li><b>FootnoteID</b> (type <b>xs:string</b>, 0..∞)</li> </ul> </li> </ul>
type	<a href="#">ExpressionConditionSetType</a> , <a href="#">OperatorType</a> ,

### 5.6.2.3 Output - Array

path	PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/FootprintRules-Array/FootprintRule/Output-Array
diagram	<p>The diagram illustrates the structure of the <b>RuleOutput-ArrayType</b> and its internal components. It is organized into nested dashed boxes representing the hierarchy of the type.</p> <ul style="list-style-type: none"> <li><b>RuleOutput-ArrayType</b> (outermost dashed box):             <ul style="list-style-type: none"> <li>Contains an <b>Output-Array</b> class (type: RuleOutput-ArrayType) connected to an <b>Output</b> class (type: RuleOutputType) via a 1-to-many association (1 to 1..∞).</li> <li>Contains a <b>FootnoteID</b> class (type: xs:string) with a multiplicity of 0..∞.</li> </ul> </li> <li><b>RuleOutputType</b> (middle dashed box):             <ul style="list-style-type: none"> <li>Contains an <b>OutputXPath</b> class (type: xs:string).</li> <li>Contains a <b>Token</b> class (type: ExpressionTokenType) with a multiplicity of 1..∞.</li> </ul> </li> <li><b>ExpressionTokenType</b> (innermost dashed box):             <ul style="list-style-type: none"> <li>Contains a <b>ConditionID</b> class (type: xs:string).</li> <li>Contains a <b>ConditionSetID</b> class (type: xs:string).</li> <li>Contains a <b>FunctionStart</b> class (type: FunctionType).</li> <li>Contains an <b>XPath</b> class (type: xs:string).</li> <li>Contains a <b>Value</b> class (type: xs:decimal).</li> <li>Contains a <b>ValueText</b> class (type: xs:string).</li> <li>Contains a <b>NULL</b> class (type: JEP30-D10:EmptyType).</li> <li>Contains an <b>Operator</b> class (type: OperatorType).</li> <li>Contains a <b>FunctionEnd</b> class (type: FunctionType).</li> </ul> </li> </ul>
type	RuleOutput-ArrayType, RuleOutputType, ExpressionTokenType, FunctionType, JEP30-D10:EmptyType, OperatorType.

#### 5.6.2.4 Intermediary Rule Value - Array

path	<a href="#">PartModel/DesignKitSection/FootprintRuleDesignKit-Array/FootprintRuleDesignKit/FootprintRules-Array/IntermediaryRuleValue-Array</a>
diagram	<p>The diagram illustrates the XSD structure for the <b>IntermediaryRuleValue-Array</b> type. It consists of two main components:</p> <ul style="list-style-type: none"> <li><b>IntermediaryRuleValue-ArrayType</b>: This is the base type, represented by a dashed box. It contains a sequence of <b>IntermediaryRuleValue</b> elements (indicated by a box with a dashed border and a cardinality of 1..∞).</li> <li><b>IntermediaryRuleValueType</b>: This is the base type for the <b>IntermediaryRuleValue</b> elements, represented by a solid box. It contains the following elements: <ul style="list-style-type: none"> <li><b>ID</b>: A required element of type <code>xs:string</code>.</li> <li><b>Name</b>: A required element of type <code>xs:string</code>.</li> <li><b>Value</b>: A required element of type <code>xs:decimal</code>.</li> <li><b>ValueText</b>: A required element of type <code>xs:string</code>.</li> <li><b>FootnoteID</b>: An optional element (indicated by a dashed border) of type <code>xs:string</code> with a cardinality of 0..∞.</li> <li><b>any ##any</b>: A wildcard element that can contain any content.</li> </ul> </li> </ul> <p>The <b>IntermediaryRuleValue-Array</b> type is shown as a dashed box on the left, and the <b>IntermediaryRuleValueType</b> is shown as a solid box on the right. The <b>IntermediaryRuleValue</b> element is shown as a box with a dashed border in the middle, indicating it is a base type for the array.</p>
type	<a href="#">IntermediaryRuleValue-ArrayType</a> , <a href="#">IntermediaryRuleValueType</a> .

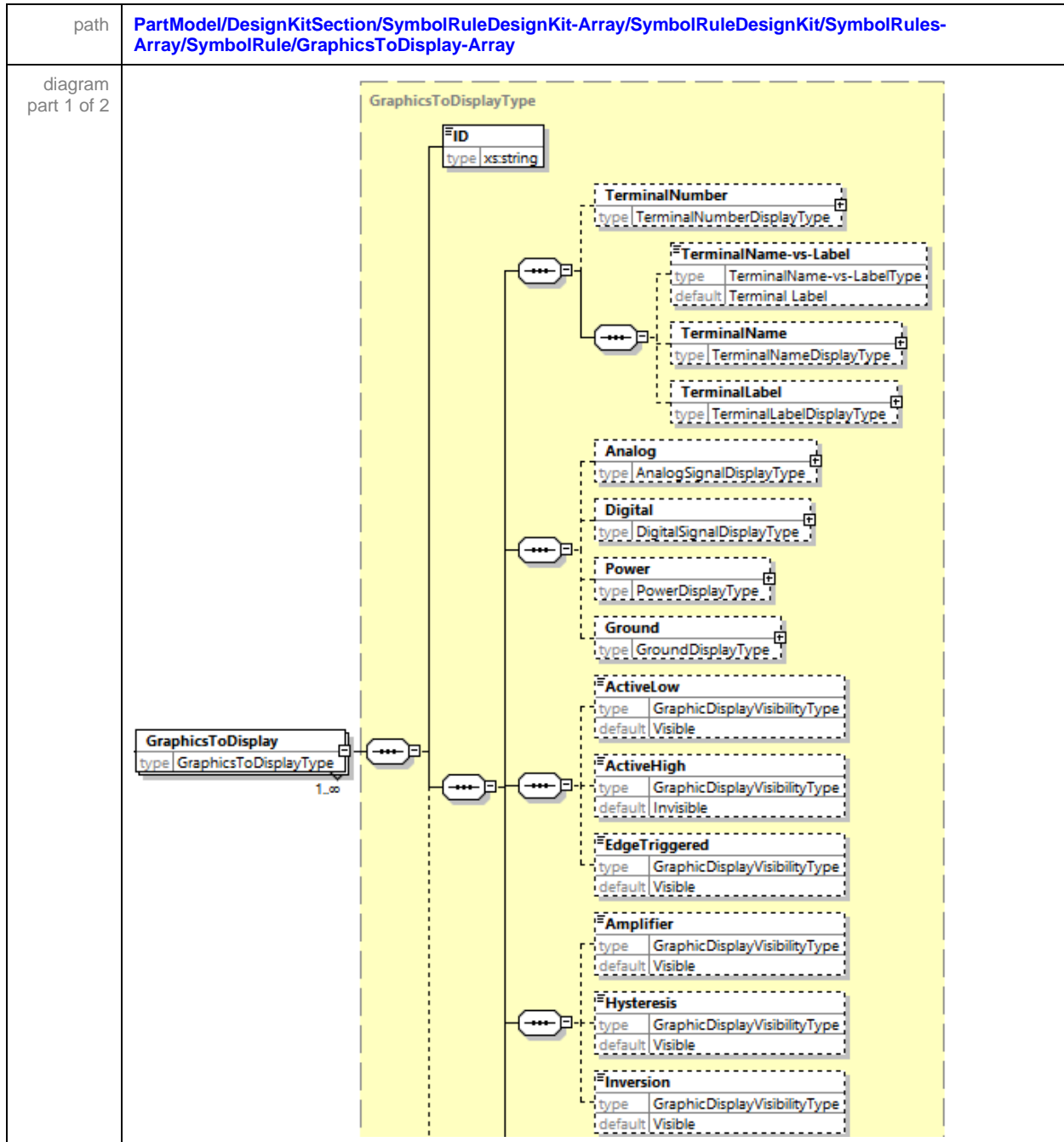
## 5.7 Symbol Rule Design Kit - Array

path	<b>PartModel/DesignKitSection/SymbolRuleDesignKit-Array</b>
diagram	
type	<b>SymbolRuleDesignKit-ArrayType, SymbolRuleDesignKitType, JEP30-D10:Footnote-ArrayType, ds:SignatureType</b>

### 5.7.1 Symbol Rule - Array

path	<b>PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array</b>
diagram	
type	<b>SymbolRules-ArrayType, SymbolRuleType, GraphicsToDisplay-ArrayType, GraphicsToDisplayType, JEP30-D10:DefaultTextFormatType, JEP30-D10:DefaultGraphicalFormatType.</b>

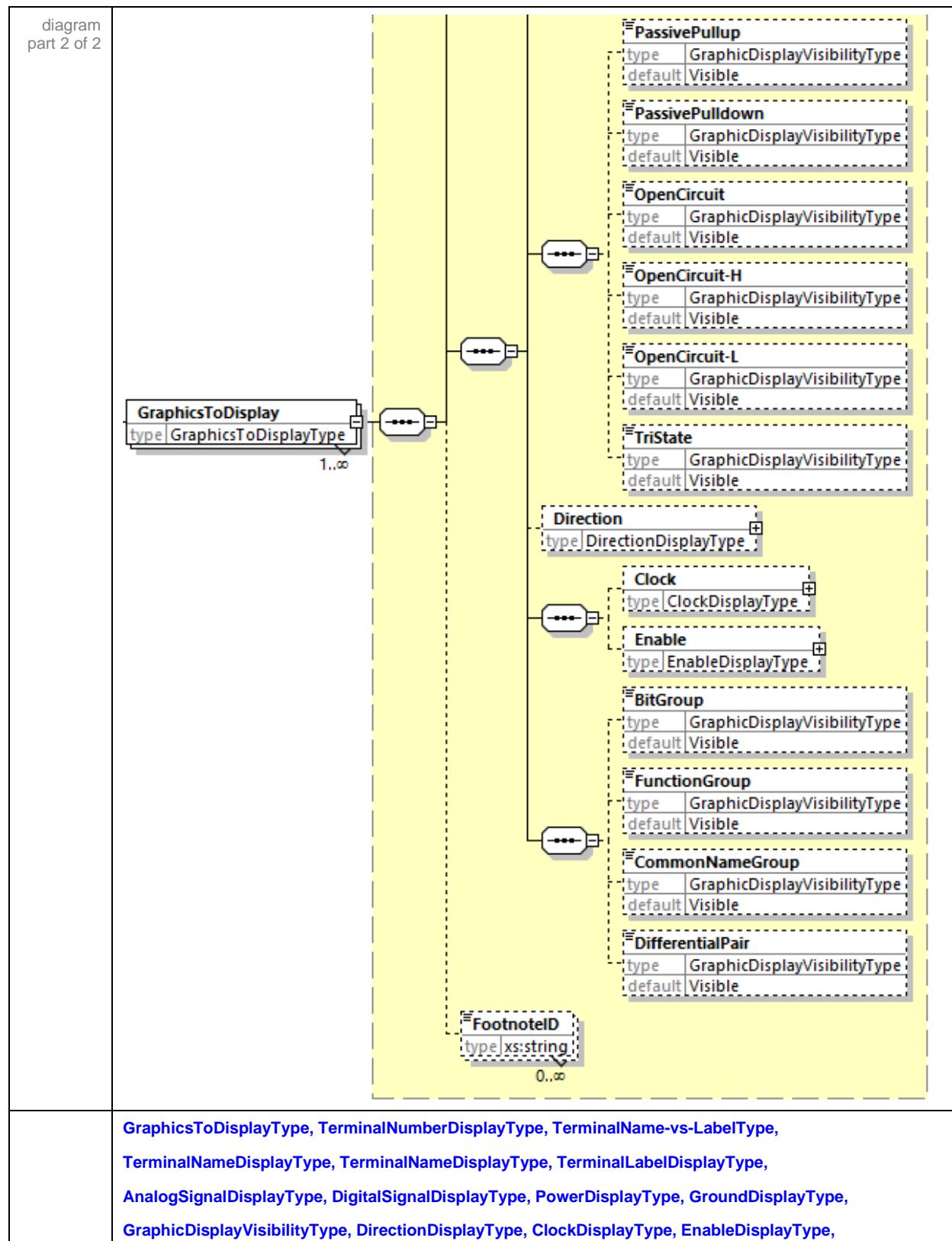
### 5.7.1.1 Graphics To Display - Array



The enumerated values of the *TerminalName-vs-LabelType* are *Terminal Name* and *Terminal Label*. This is set to a default of *Terminal Label* indicating that when a terminal name and a terminal label exists for a given terminal the display of the *Terminal Label* takes precedence over the *Terminal Name*. This typically applies to standard electronics discrete devices such as Diodes, Transistors, etc. where the terminal name of Base, Collector and Emitter are replaced by their terminal labels of B, C and E respectively.

The enumerated values of the *GraphicDisplayVisibilityType* are *Visible* and *Invisible*.

### 5.6.1.3 Graphic To Display - Array (cont'd)





#### 5.7.1.1.1 Terminal Number

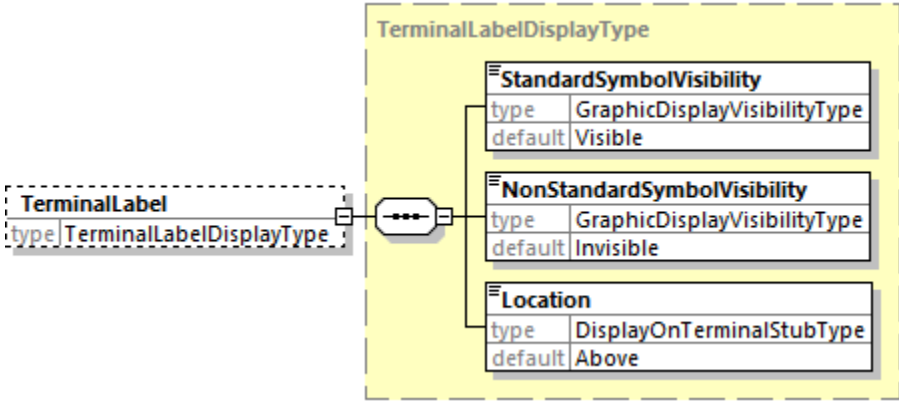
path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/TerminalNumber
diagram	
type	TerminalNumberDisplayType, GraphicDisplayVisibilityType, DisplayOnTerminalStubType.

The enumerated values of the *DisplayOnTerminalStubType* are *Above* and *Below*.

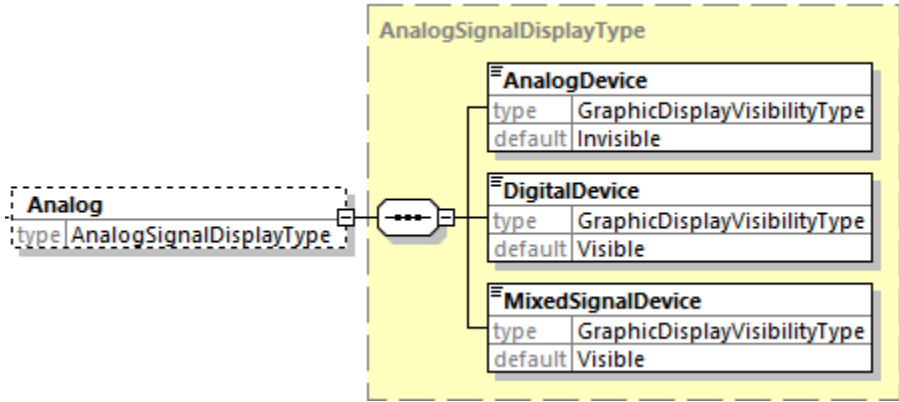
#### 5.7.1.1.2 Terminal Name

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/TerminalName
diagram	
type	TerminalNameDisplayType, GraphicDisplayVisibilityType, DisplayOnTerminalStubType.

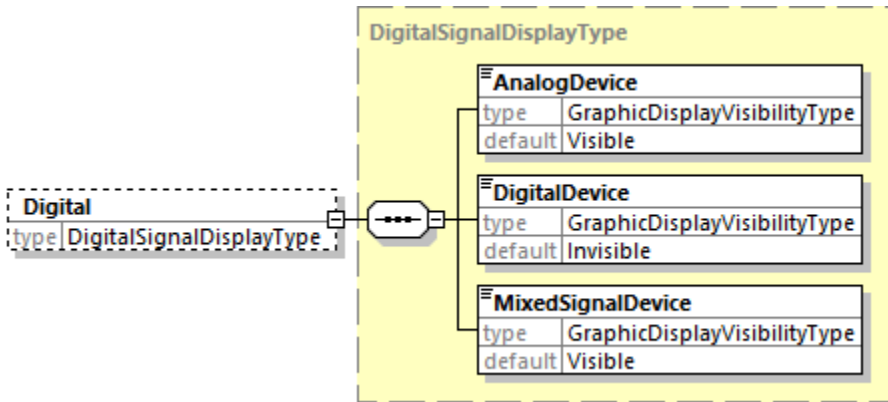
5.7.1.1.3 Terminal Label

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/TerminalLabel																		
diagram	 <p>The diagram shows a dashed box labeled <b>TerminalLabel</b> with the text <code>type TerminalLabelDisplayType</code> below it. A line connects this box to a central port symbol (a circle with three dots). To the right of the port symbol is a large yellow dashed box labeled <b>TerminalLabelDisplayType</b>. Inside this box are three stacked property tables:</p> <table><tr><th colspan="2">StandardSymbolVisibility</th></tr><tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr><tr><td>default</td><td>Visible</td></tr></table> <table><tr><th colspan="2">NonStandardSymbolVisibility</th></tr><tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr><tr><td>default</td><td>Invisible</td></tr></table> <table><tr><th colspan="2">Location</th></tr><tr><td>type</td><td>DisplayOnTerminalStubType</td></tr><tr><td>default</td><td>Above</td></tr></table>	StandardSymbolVisibility		type	GraphicDisplayVisibilityType	default	Visible	NonStandardSymbolVisibility		type	GraphicDisplayVisibilityType	default	Invisible	Location		type	DisplayOnTerminalStubType	default	Above
StandardSymbolVisibility																			
type	GraphicDisplayVisibilityType																		
default	Visible																		
NonStandardSymbolVisibility																			
type	GraphicDisplayVisibilityType																		
default	Invisible																		
Location																			
type	DisplayOnTerminalStubType																		
default	Above																		
type	TerminalLabelDisplayType, GraphicDisplayVisibilityType, DisplayOnTerminalStubType.																		

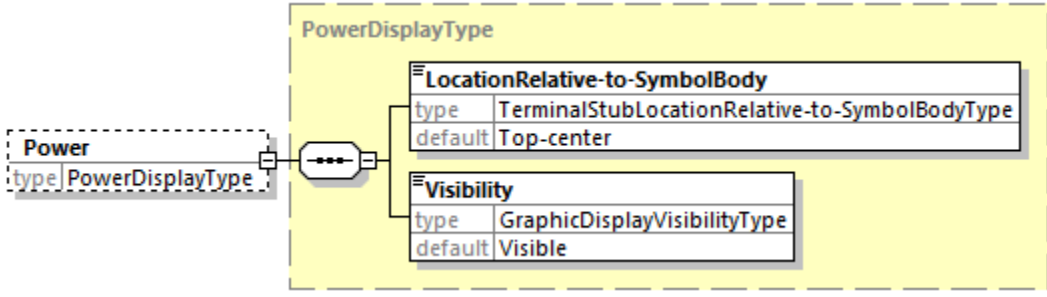
5.7.1.1.4 Analog

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Analog																		
diagram	 <p>The diagram shows a dashed box labeled <b>Analog</b> with the text <code>type AnalogSignalDisplayType</code> below it. A line connects this box to a central port symbol (a circle with three dots). To the right of the port symbol is a large yellow dashed box labeled <b>AnalogSignalDisplayType</b>. Inside this box are three stacked property tables:</p> <table><tr><th colspan="2">AnalogDevice</th></tr><tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr><tr><td>default</td><td>Invisible</td></tr></table> <table><tr><th colspan="2">DigitalDevice</th></tr><tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr><tr><td>default</td><td>Visible</td></tr></table> <table><tr><th colspan="2">MixedSignalDevice</th></tr><tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr><tr><td>default</td><td>Visible</td></tr></table>	AnalogDevice		type	GraphicDisplayVisibilityType	default	Invisible	DigitalDevice		type	GraphicDisplayVisibilityType	default	Visible	MixedSignalDevice		type	GraphicDisplayVisibilityType	default	Visible
AnalogDevice																			
type	GraphicDisplayVisibilityType																		
default	Invisible																		
DigitalDevice																			
type	GraphicDisplayVisibilityType																		
default	Visible																		
MixedSignalDevice																			
type	GraphicDisplayVisibilityType																		
default	Visible																		
type	AnalogSignalDisplayType, GraphicDisplayVisibilityType.																		

### 5.7.1.1.5 Digital

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Digital												
diagram	 <p>The diagram shows a dashed box labeled 'Digital' with 'type DigitalSignalDisplayType'. This is connected to a central symbol body (a circle with three dots). To the right of the symbol body is a large yellow dashed box labeled 'DigitalSignalDisplayType'. Inside this box are three stacked property tables:</p> <ul style="list-style-type: none"> <li><b>AnalogDevice</b> <table border="1"> <tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr> <tr><td>default</td><td>Visible</td></tr> </table> </li> <li><b>DigitalDevice</b> <table border="1"> <tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr> <tr><td>default</td><td>Invisible</td></tr> </table> </li> <li><b>MixedSignalDevice</b> <table border="1"> <tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr> <tr><td>default</td><td>Visible</td></tr> </table> </li> </ul>	type	GraphicDisplayVisibilityType	default	Visible	type	GraphicDisplayVisibilityType	default	Invisible	type	GraphicDisplayVisibilityType	default	Visible
type	GraphicDisplayVisibilityType												
default	Visible												
type	GraphicDisplayVisibilityType												
default	Invisible												
type	GraphicDisplayVisibilityType												
default	Visible												
type	DigitalSignalDisplayType, GraphicDisplayVisibilityType.												

### 5.7.1.1.6 Power

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Power								
diagram	 <p>The diagram shows a dashed box labeled 'Power' with 'type PowerDisplayType'. This is connected to a central symbol body (a circle with three dots). To the right of the symbol body is a large yellow dashed box labeled 'PowerDisplayType'. Inside this box are two stacked property tables:</p> <ul style="list-style-type: none"> <li><b>LocationRelative-to-SymbolBody</b> <table border="1"> <tr><td>type</td><td>TerminalStubLocationRelative-to-SymbolBodyType</td></tr> <tr><td>default</td><td>Top-center</td></tr> </table> </li> <li><b>Visibility</b> <table border="1"> <tr><td>type</td><td>GraphicDisplayVisibilityType</td></tr> <tr><td>default</td><td>Visible</td></tr> </table> </li> </ul>	type	TerminalStubLocationRelative-to-SymbolBodyType	default	Top-center	type	GraphicDisplayVisibilityType	default	Visible
type	TerminalStubLocationRelative-to-SymbolBodyType								
default	Top-center								
type	GraphicDisplayVisibilityType								
default	Visible								
type	PowerDisplayType, TerminalStubLocationRelative-to-SymbolBodyType, GraphicDisplayVisibilityType.								

The enumerated values of the *TerminalStubLocationRelative-to-SymbolBodyType* are

<i>Left-top,</i>	<i>Right-top,</i>	<i>Top-left,</i>	<i>Bottom-left,</i>
<i>Left-center,</i>	<i>Right-center,</i>	<i>Top-center,</i>	<i>Bottom-center,</i>
<i>Left-bottom,</i>	<i>Right-bottom,</i>	<i>Top-right,</i>	<i>Bottom-right,</i>
<i>Left,</i>	<i>Right,</i>	<i>Top,</i>	<i>Bottom.</i>

5.7.1.1.7 Ground

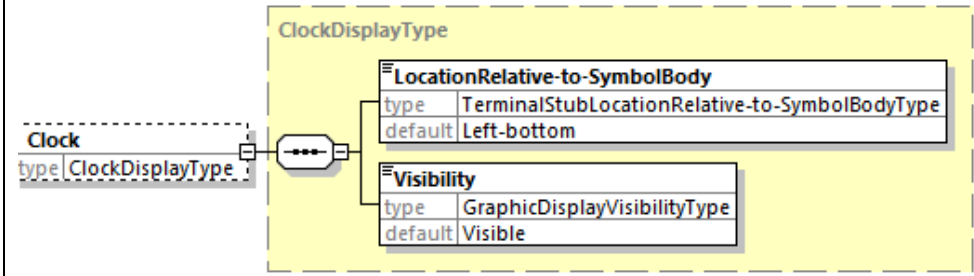
path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Ground
diagram	<p>The diagram illustrates the 'Ground' symbol and its associated properties. On the left, a dashed box labeled 'Ground' contains a small square symbol with a horizontal line and a circle. To the right of this symbol is a large yellow box labeled 'GroundDisplayType'. Inside this box, there are two property tables. The first table, titled 'LocationRelative-to-SymbolBody', has two rows: 'type' with the value 'TerminalStubLocationRelative-to-SymbolBodyType' and 'default' with the value 'Top-center'. The second table, titled 'Visibility', has two rows: 'type' with the value 'GraphicDisplayVisibilityType' and 'default' with the value 'Visible'.</p>
type	GroundDisplayType, TerminalStubLocationRelative-to-SymbolBodyType, GraphicDisplayVisibilityType.

### 5.7.1.1.8 Direction

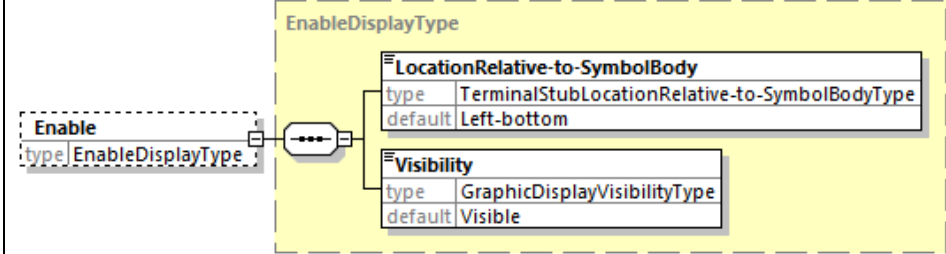
path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Direction
diagram	
type	DirectionDisplayType, InDirectionDisplayType, TerminalStubLocationRelative-to-SymbolBodyType, GraphicDisplayVisibilityType, OutDirectionDisplayType, BidirectionalGraphicType.

The enumerated values of the *BidirectionalGraphicType* are *Both Directions Simultaneously* and *Only One Direction-at-a-time*.

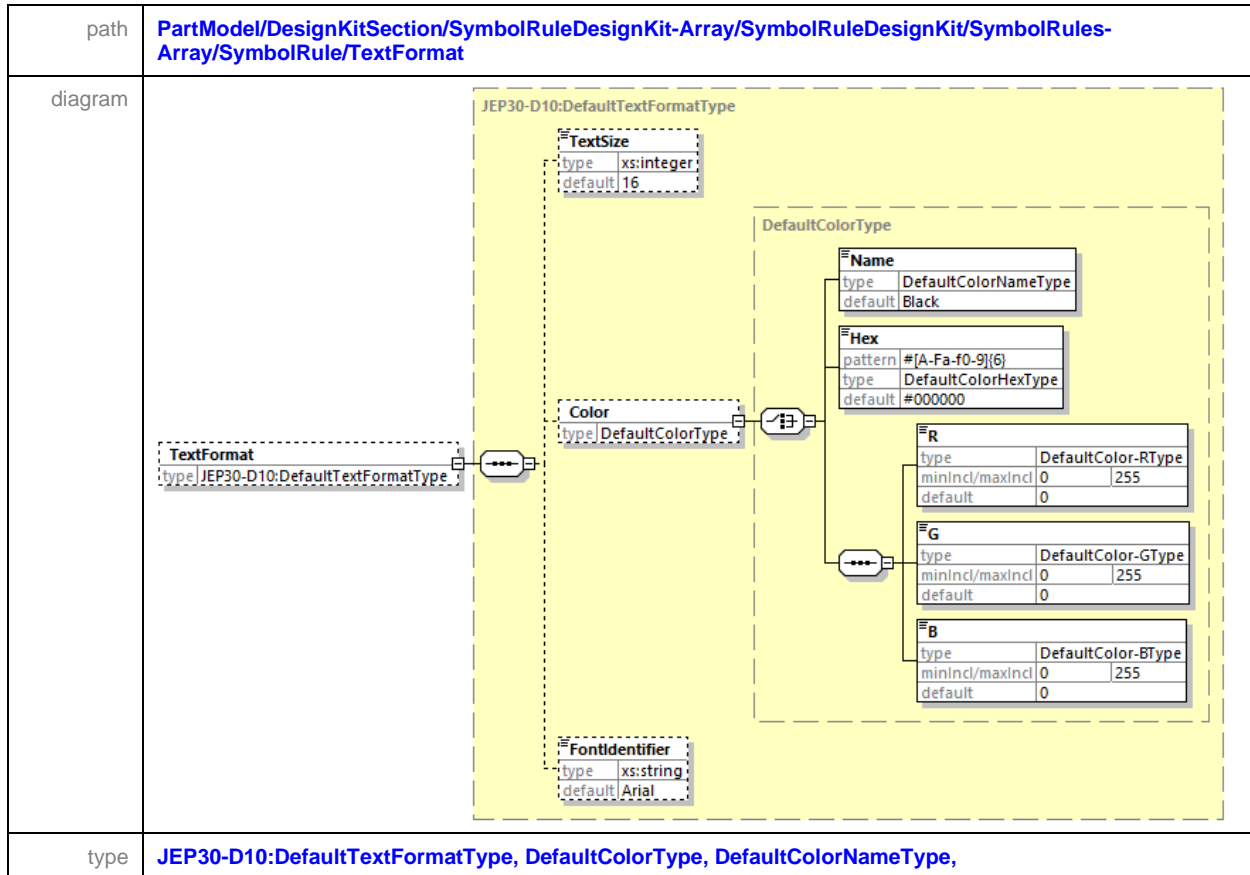
5.7.1.1.9 Clock

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Direction
diagram	
type	ClockDisplayType, TerminalStubLocationRelative-to-SymbolBodyType, GraphicDisplayVisibilityType.

5.7.1.1.10 Enable

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicsToDisplay-Array/GraphicsToDisplay/Direction
diagram	
type	EnableDisplayType, TerminalStubLocationRelative-to-SymbolBodyType, GraphicDisplayVisibilityType.

### 5.7.1.2 Text Format



The [DefaultTextFormat](#) does not have a specific font style since the default font style is normal (i.e., Not Bold, nor Italics nor Underline).

[ColorNameType](#) as defined in the [Color/Name](#) element list the names of the Scalable Vector Graphics (SVG) Colors as defined by the Scalable Vector Graphics (SVG) Specification.

[ColorHexType](#) as defined in the [Color/Hex](#) element uses a regular expression pattern to recognize the six-digit hexadecimal representation of the Scalable Vector Graphics (SVG) Colors.

[Color-RType](#), [Color-GType](#), [Color-BType](#) allows the construction of all the colors from the combination of the red, green, and blue colors in the RGB Color Space. The red, green, and blue use 8 bits each, which have integer values from 0 to 255.

The default values as follows,

- TextSize is defaulted to value “16”
- Color is default to black or its equivalent in Hex or RGB color settings.
- FontIdentifier is defaulted to value “Arial”

5.7.1.3 Graphical Format

path	PartModel/DesignKitSection/SymbolRuleDesignKit-Array/SymbolRuleDesignKit/SymbolRules-Array/SymbolRule/GraphicalFormat
diagram	
type	JEP30-D10:DefaultGraphicalFormatType, DefaultStrokeWidthType, DefaultStrokeOpacityType, DefaultStrokeLineCapType, DefaultColorType, DefaultFillOpacityType.

The *DefaultGraphicalFormat* will define the default values as follows,

- a. *StrokeWidth* is defaulted to the value 1
- b. *StrokeLineCap* is defaulted to value “Butt”
- c. *StrokeColor/Name* is defaulted to value “Black”
- d. *StrokeColor/Hex* is defaulted to value “#000000”
- e. *StrokeColor/R*, *G* and *B* are defaulted to the value 0
- f. *StrokeOpacity* and *FillOpacity* are defaulted to 100



## Annex A (informative) Differences between JEP30-K100 and its predecessors

This table briefly describes most of the changes made to entries that appear in this standard, JEP30-K100, compared to its predecessor; Punctuation changes may or may not be included.

Initial Issue:	Date: February 2025	Item Number: 11.2-1073
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### Change Record History


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**Standard Improvement Form****JEDEC Standard No. JEP30-K100**

The purpose of this form is to provide the Technical Committees of JEDEC with input from the industry regarding usage of the subject standard. Individuals or companies are invited to submit comments to JEDEC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

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3103 10th Street North  
Suite 240S  
Arlington, VA 22201

Email: [angies@jedec.org](mailto:angies@jedec.org)

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1. I recommend changes to the following:

☐ Requirement, clause number \_\_\_\_\_

☐ Test method number \_\_\_\_\_ Clause number \_\_\_\_\_

The referenced clause number has proven to be:

☐ Unclear ☐ Too Rigid ☐ In Error

☐ Other \_\_\_\_\_

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2. Recommendations for correction:


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3. Other suggestions for document improvement:


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Submitted by

Name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Zip: \_\_\_\_\_

Phone: \_\_\_\_\_

E-mail: \_\_\_\_\_

Date \_\_\_\_\_

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