IEC/TR 62258-7

Edition 1.0 2007-08

TECHNICAL
REPORT

Semiconductor die products –
Part 7: XML schema for data exchange

IEC/TR 62258-7:2007(E)

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FOREWORD

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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62258-7, which is a technical report, has been prepared by IEC technical committee 47: Semiconductor devices.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
47/1887/DTR	47/1897/RVC

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62258 series, under the general title *Semiconductor die products*, can be found on the IEC website. Further parts may be added as required.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

• reconfirmed,
• withdrawn,
• replaced by a revised edition, or
• amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

This technical report is based on the work carried out in the ESPRIT 4th Framework project GOODDIE which resulted in the publication of the ES 59008 series of European specifications. Organizations that helped prepare this report included the ESPRIT ENCAST and IST ENCASIT projects, the Die Products Consortium, JEITA, JEDEC and ZVEI.

SEMICONDUCTOR DIE PRODUCTS –

Part 7: XML schema for data exchange

1 Scope

IEC/TR 62258-7, which is a technical report, has been developed to facilitate the production, supply and use of semiconductor die products, including:

- wafers;
- singulated bare die;
- die and wafers with attached connection structures;
- minimally or partially encapsulated die and wafers.

This report contains an XML schema that describes the elements needed for data exchange and that will allow the implementation of the requirements of IEC 62258-1, IEC 62258-5 and IEC 62258-6, as well as providing an exchange structure that is complementary to those defined in IEC 62258-2. It is also complementary to and compatible with the questionnaire in IEC/TR 62258-4.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60050 (all parts), *International Electrotechnical Vocabulary*

IEC 62258-1: *Semiconductor die products – Part 1: Requirements for procurement and use*

IEC 62258-2: *Semiconductor die products – Part 2: Exchange data formats*

IEC/TR 62258-4: *Semiconductor die products – Part 4: Questionnaire for die users and suppliers*

IEC 62258-5: *Semiconductor die products – Part 5 Requirements for information concerning electrical simulation*

IEC 62258-6: *Semiconductor die products – Part 6 Requirements for information concerning thermal simulation*

3 Terms and definitions

For the purposes of this document, relevant terms, which are defined in IEC 60050, together with additional terms and acronyms as given in IEC 62258-1, apply.

4 General

The schema given in this technical report complies with Version 1.0 (Third edition) of the Extensible Markup Language (XML) as defined by the World Wide Web Consortium (W3C). Links to the XML standard are given in the bibliography.

To comply with IEC 62258-1, that standard requires that suppliers of die devices shall furnish information that is necessary and sufficient for users of die devices at all stages of design, procurement, manufacture and test of products containing them. The schema in Annex A defines an exchange mechanism for structuring such information using an XML representation and as such is intended as an aid to compliance with the standard.

Whilst it is expected that much of the information supplied will be in the public domain and available from such sources as manufacturers' data sheets, neither the standard nor the schema places an obligation on a supplier to make information public. Any information that a supplier considers to be proprietary or commercially sensitive may be supplied under the terms of a non-disclosure agreement.

5 Data exchange

The schema in Annex A implements all the entities as defined by IEC 62258-2 for the DDX format. In addition, it includes additional entities extending the range of that data as follows:

- expansion of data on organisations (manufacturer, supplier etc.) to include addresses and contacts;
- sub-division of some entities to make their values clearer.

Annex B contains an example of an XML file based on the schema using a fictitious example similar to that employed in IEC 62258-2, and extended to cover additional data requirements. It is possible that software may be available for conversion of data produced using the spreadsheet associated with IEC/TR 62258-4 into this format. In any case, a wide range of tools is available commercially for handling and processing XML files.

The electronic form of the schema contained in this technical report may be downloaded from the IEC website. The copyright conditions applying to the use of the electronic file are those that apply to IEC database standards, which permit the use of such information in electronic form for bona-fide e-commerce but do not permit its sale to third parties or other commercial use.

Annex A
(normative)

XML schema

In electronic form, for use by the example file shown in Annex B, the file containing this schema is assumed to have the name `DDXschema.xsd`

```xml
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">

<!-- Declaration of simple types -->

 <xs:simpleType name="NAME_Type">
  <xs:restriction base="xs:string"/>
 </xs:simpleType>

 <xs:simpleType name="LIST_Type">
  <xs:list itemType="xs:string"/>
 </xs:simpleType>

 <xs:simpleType name="DATE_Type">
  <xs:restriction base="xs:date"/>
 </xs:simpleType>

 <xs:simpleType name="COUNT_Type">
  <xs:restriction base="xs:integer">
   <xs:minInclusive value="1"/>
  </xs:restriction>
 </xs:simpleType>

 <xs:simpleType name="LENGTH_Type">
  <xs:restriction base="xs:decimal">
   <xs:minInclusive value="0"/>
  </xs:restriction>
 </xs:simpleType>

 <xs:simpleType name="NEGATIVE_LENGTH_Type">
  <xs:restriction base="xs:decimal">
   <xs:maxInclusive value="0"/>
  </xs:restriction>
 </xs:simpleType>

 <xs:simpleType name="ANGLE_Type">
  <xs:restriction base="xs:decimal">
   <xs:minInclusive value="0"/>
   <xs:maxInclusive value="360"/>
  </xs:restriction>
 </xs:simpleType>

 <xs:simpleType name="TEMPERATURE_Type">
  <xs:restriction base="xs:decimal"/>
 </xs:simpleType>

 <xs:simpleType name="TIME_Type">
  <xs:restriction base="xs:decimal"/>
 </xs:simpleType>

 <xs:simpleType name="POWER_Type">
  <xs:restriction base="xs:decimal">
   <xs:minInclusive value="0"/>
  </xs:restriction>
 </xs:simpleType>
```

```xml
<xs:simpleType name="DEVICE_FORM_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="bare_die"/>
  <xs:enumeration value="bumped_die"/>
  <xs:enumeration value="lead_frame_die"/>
  <xs:enumeration value="minimally_packaged_device"/>
  <xs:enumeration value="MPD"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="SIGNAL_TYPE_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="I"/>
  <xs:enumeration value="O"/>
  <xs:enumeration value="B"/>
  <xs:enumeration value="G"/>
  <xs:enumeration value="V"/>
  <xs:enumeration value="A"/>
  <xs:enumeration value="N"/>
  <xs:enumeration value="U"/>
  <xs:enumeration value="T"/>
  <xs:enumeration value="X"/>
  <xs:enumeration value="H"/>
  <xs:enumeration value="L"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="CONNECTION_REQUIREMENT_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="CONN"/>
  <xs:enumeration value="ISOL"/>
  <xs:enumeration value="OPT"/>
  <xs:enumeration value="N/A"/>
  <xs:enumeration value="N/K"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="VIEW_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="top"/>
  <xs:enumeration value="bottom"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="GEOMETRIC_UNIT_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="metre"/>
  <xs:enumeration value="millimetre"/>
  <xs:enumeration value="micrometre"/>
  <xs:enumeration value="micron"/>
  <xs:enumeration value="mil"/>
  <xs:enumeration value="mm"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="MIRROR_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="MX"/>
  <xs:enumeration value="MY"/>
  <xs:enumeration value="MXMY"/>
  <xs:enumeration value="MYMX"/>
 </xs:restriction>
</xs:simpleType>
```

```
<xs:simpleType name="WAFER_UNIT_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="inch"/>
  <xs:enumeration value="millimetre"/>
  <xs:enumeration value="mm"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="INDEX_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="flat"/>
  <xs:enumeration value="notch"/>
 </xs:restriction>
</xs:simpleType>

<xs:simpleType name="MOISTURE_SENSITIVITY_LEVEL_Type">
 <xs:restriction base="xs:string">
  <xs:enumeration value="1"/>
  <xs:enumeration value="2"/>
  <xs:enumeration value="2a"/>
  <xs:enumeration value="3"/>
  <xs:enumeration value="4"/>
  <xs:enumeration value="5"/>
  <xs:enumeration value="5a"/>
  <xs:enumeration value="6"/>
 </xs:restriction>
</xs:simpleType>

<!-- Declaration of complex types -->

<xs:complexType name="REFERENCE">
 <xs:attribute name="REF" type="xs:string" use="required"/>
</xs:complexType>

<xs:complexType name="SIZE_VALUE_Type" abstract="false">
 <xs:attribute name="X_SIZE" type="LENGTH_Type" use="required"/>
 <xs:attribute name="Y_SIZE" type="LENGTH_Type" use="required"/>
</xs:complexType>

<xs:complexType name="TOLERANCE_Type" abstract="false">
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 <xs:attribute name="POS" type="LENGTH_Type" use="required"/>
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<xs:complexType name="CIRCLE_Type" abstract="false">
 <xs:attribute name="RADIUS" type="LENGTH_Type" use="required"/>
</xs:complexType>

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 <xs:attribute name="X" type="xs:decimal" use="required"/>
 <xs:attribute name="Y" type="xs:decimal" use="required"/>
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  <xs:element name="VERTEX" type="POSITION_Type" minOccurs="3"
    maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>
```

```xml
<xs:complexType name="ORIENTATION_Type" abstract="false">
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 <xs:attribute name="MIRROR" type="MIRROR_Type"/>
</xs:complexType>

<xs:complexType name="WAFER_SIZE_Type" abstract="false">
 <xs:attribute name="DIAMETER" type="LENGTH_Type" use="required"/>
 <xs:attribute name="UNITS" type="WAFER_UNIT_Type" use="required"/>
</xs:complexType>

<xs:complexType name="WAFER_INDEX_Type" abstract="false">
 <xs:attribute name="INDEX" type="INDEX_Type" use="required"/>
 <xs:attribute name="ORIENTATION" type="ANGLE_Type" use="required"/>
</xs:complexType>

<xs:complexType name="MANUFACTURERS_Type" abstract="false">
 <xs:sequence>
  <xs:element name="MANUFACTURER" type="ORGANISATION_Type"/>
  <xs:element name="WAFER_FAB" type="ORGANISATION_Type" minOccurs="0"/>
  <xs:element name="TESTING_FACILITY" type="ORGANISATION_Type"
    minOccurs="0"/>
  <xs:element name="PACKING_FACILITY" type="ORGANISATION_Type"
    minOccurs="0"/>
 </xs:sequence>
</xs:complexType>

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  <xs:element name="TECHNOLOGY" type="xs:string" minOccurs="0"/>
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    minOccurs="0"/>
  <xs:element name="SUBSTRATE_MATERIAL" type="xs:string" minOccurs="0"/>
  <xs:element name="METALLISATION" type="xs:string" minOccurs="0"/>
  <xs:element name="PASSIVATION" type="xs:string" minOccurs="0"/>
  <xs:element name="BACKSIDE_DETAIL" type="xs:string" minOccurs="0"/>
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  <xs:element name="BUMP_MATERIAL" type="xs:string"/>
  <xs:element name="SHAPE" type="xs:string" minOccurs="0"/>
  <xs:element name="SIZE" type="SIZE_VALUE_Type" minOccurs="0"/>
  <xs:element name="HEIGHT" type="LENGTH_Type"/>
  <xs:element name="HEIGHT_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
  <xs:element name="BUMP_SPECIFICATION_DRAWING"
    type="DOCUMENT_OR_GRAPHICS_Type" minOccurs="0"
     maxOccurs="unbounded"/>
  <xs:element name="BUMP_ATTACHMENT_METHOD" type="xs:string"
    minOccurs="0"/>
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</xs:complexType>
```

```
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  <xs:element name="PACKAGE_MATERIAL" type="xs:string" minOccurs="0"/>
  <xs:element name="MOISTURE_SENSITIVITY_LEVEL"
    type="MOISTURE_SENSITIVITY_LEVEL_Type" minOccurs="0"/>
  <xs:element name="PACKAGE_STYLE" type="xs:string" minOccurs="0"/>
  <xs:element name="OUTLINE_DRAWING" type="DOCUMENT_OR_GRAPHICS_Type"
    minOccurs="0" maxOccurs="unbounded"/>
 </xs:sequence>
</xs:complexType>

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  <xs:element name="FILE_NAME" type="NAME_Type" minOccurs="0"/>
  <xs:element name="VERSION" type="NAME_Type" minOccurs="0"/>
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  <xs:element name="TEMPERATURE_RANGE" type="TEMPERATURE_RANGE_Type"
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  <xs:element name="WAFER_THICKNESS" type="LENGTH_Type" minOccurs="0"/>
  <xs:element name="WAFER_DIE_STEP_SIZE" type="SIZE_VALUE_Type"
    minOccurs="0"/>
  <xs:element name="WAFER_GROSS_DIE_COUNT" type="COUNT_Type"
    minOccurs="0"/>
  <xs:element name="WAFER_INDEX" type="WAFER_INDEX_Type" minOccurs="0"/>
  <xs:element name="WAFER_RETICULE_STEP_SIZE" type="SIZE_VALUE_Type"
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    minOccurs="0"/>
 </xs:sequence>
</xs:complexType>

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  <xs:element name="ADDITIONAL_SCREENING" type="xs:string" minOccurs="0"/>
  <xs:element name="PRODUCT_STATUS" type="xs:string" minOccurs="0"/>
  <xs:element name="TESTABILITY_FEATURES" type="xs:string" minOccurs="0"/>
  <xs:element name="ADDITIONAL_TEST_REQUIREMENTS" type="xs:string"
    minOccurs="0"/>
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</xs:complexType>
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```
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 </xs:sequence>
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 <xs:attribute name="UNITS" type="xs:string" use="required"/>
</xs:complexType>

<xs:complexType name="RELIABILITY_Type" abstract="false">
 <xs:sequence>
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    type="DOCUMENT_OR_GRAPHICS_Type" minOccurs="0"/>
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 <xs:attribute name="UNITS" type="xs:string" use="required"/>
</xs:complexType>

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  <xs:element name="ATTACH_METHODS" type="xs:string" minOccurs="0"/>
  <xs:element name="ATTACH_MATERIALS" type="xs:string" minOccurs="0"/>
  <xs:element name="BONDING_METHODS" type="xs:string" minOccurs="0"/>
  <xs:element name="BONDING_MATERIALS" type="xs:string" minOccurs="0"/>
  <xs:element name="ASSEMBLY_LIMITATIONS" type="xs:string" minOccurs="0"/>
  <xs:element name="PROCESS_LIMITATIONS" type="xs:string" minOccurs="0"/>
  <xs:element name="STORAGE_LIMITATIONS" type="xs:string" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>

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  <xs:element name="REQUIREMENT" type="CONNECTION_REQUIREMENT_Type"/>
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 </xs:sequence>
</xs:complexType>

<xs:complexType name="DIE_DIMENSIONS_Type" abstract="false">
 <xs:sequence>
  <xs:element name="GEOMETRIC_UNITS" type="GEOMETRIC_UNIT_Type"/>
  <xs:element name="GEOMETRIC_ORIGIN" type="POSITION_Type"/>
  <xs:element name="GEOMETRIC_VIEW" type="VIEW_Type"/>
  <xs:element name="DIE_SIZE" type="SIZE_VALUE_Type"/>
  <xs:element name="DIE_THICKNESS" type="LENGTH_Type"/>
  <xs:element name="LENGTH_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
  <xs:element name="WIDTH_TOLERANCE" type="TOLERANCE_Type" minOccurs="0"/>
  <xs:element name="THICKNESS_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
  <xs:element name="TERMINAL_LENGTH_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
  <xs:element name="TERMINAL_WIDTH_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
  <xs:element name="TERMINAL_X_POSITION_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
  <xs:element name="TERMINAL_Y_POSITION_TOLERANCE" type="TOLERANCE_Type"
    minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
```

```
<xs:complexType name="ORGANISATION_Type" abstract="false">
 <xs:sequence>
  <xs:element name="NAME" type="NAME_Type"/>
  <xs:element name="INTERNAL_LOCATION" type="xs:string" minOccurs="0"/>
  <xs:element name="STREET_NUMBER" type="xs:string" minOccurs="0"/>
  <xs:element name="STREET" type="xs:string" minOccurs="0"/>
  <xs:element name="POSTAL_BOX" type="xs:string" minOccurs="0"/>
  <xs:element name="TOWN" type="xs:string" minOccurs="0"/>
  <xs:element name="REGION" type="xs:string" minOccurs="0"/>
  <xs:element name="POSTAL_CODE" type="xs:string" minOccurs="0"/>
  <xs:element name="COUNTRY" type="xs:string" minOccurs="0"/>
  <xs:element name="ISO_COUNTRY_CODE" type="xs:string"
    minOccurs="0"/>
  <xs:element name="FACSIMILE_NUMBER" type="xs:string" minOccurs="0"/>
  <xs:element name="TELEPHONE_NUMBER" type="xs:string" minOccurs="0"/>
  <xs:element name="ELECTRONIC_MAIL_ADDRESS" type="xs:string"
    minOccurs="0"/>
  <xs:element name="TELEX_NUMBER" type="xs:string" minOccurs="0"/>
  <xs:element name="CONTACT" type="CONTACT_Type" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>

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 <xs:sequence>
  <xs:element name="NAME" type="NAME_Type"/>
  <xs:element name="DEPARTMENT" type="NAME_Type" minOccurs="0"/>
  <xs:element name="TELEPHONE_NUMBER" type="xs:string" minOccurs="0"/>
  <xs:element name="ELECTRONIC_MAIL_ADDRESS" type="xs:string"
    minOccurs="0"/>
 </xs:sequence>
</xs:complexType>

<xs:complexType name="TERMINAL_OR_GROUP_Type" abstract="false">
 <xs:sequence>
  <xs:choice>
   <xs:element name="TERMINAL_REF" type="REFERENCE"/>
   <xs:element name="TERMINAL_GROUP_REF" type="REFERENCE"/>
  </xs:choice>
 </xs:sequence>
</xs:complexType>

<xs:complexType name="PERMUTABLE_Type" abstract="false">
 <xs:sequence>
  <xs:choice>
   <xs:element name="TERMINAL_REF" type="REFERENCE" minOccurs="2"
    maxOccurs="unbounded"/>
   <xs:element name="TERMINAL_GROUP_REF" type="REFERENCE" minOccurs="2"
    maxOccurs="unbounded"/>
  </xs:choice>
 </xs:sequence>
</xs:complexType>
```

```
<!-- Declaration of global elements -->

 <xs:element name="TERMINAL">
  <xs:complexType>
   <xs:sequence>
    <xs:element name="TERMINAL_IDENTIFIER" type="xs:string"/>
    <xs:element name="TERMINAL_NUMBER" type="xs:string" minOccurs="0"/>
    <xs:element name="TERMINAL_TYPE_NAME">
     <xs:complexType>
      <xs:sequence>
       <xs:element name="TERMINAL_TYPE_REF" type="REFERENCE"/>
      </xs:sequence>
     </xs:complexType>
    </xs:element>
    <xs:element name="TERMINAL_POSITION" type="POSITION_Type"/>
    <xs:element name="ORIENTATION" type="ORIENTATION_Type"/>
    <xs:element name="SIGNAL_NAME" type="xs:string" minOccurs="0"/>
    <xs:element name="SIGNAL_TYPE" type="SIGNAL_TYPE_Type" minOccurs="0"/>
   </xs:sequence>
   <xs:attribute name="TERMID" type="xs:string" use="required"/>
  </xs:complexType>
 </xs:element>

 <xs:element name="TERMINAL_GROUP">
  <xs:complexType>
   <xs:sequence>
    <xs:element name="GROUP_NAME" type="NAME_Type"/>
    <xs:element name="TERMINAL_OR_GROUP" type="TERMINAL_OR_GROUP_Type"
      minOccurs="2" maxOccurs="unbounded"/>
   </xs:sequence>
   <xs:attribute name="GROUPID" type="xs:string" use="required"/>
  </xs:complexType>
 </xs:element>

 <xs:element name="TERMINAL_TYPE">
  <xs:complexType>
   <xs:sequence>
    <xs:element name="TERMINAL_TYPE_NAME" type="xs:string"/>
    <xs:choice>
     <xs:element name="RECTANGLE" type="SIZE_VALUE_Type"/>
     <xs:element name="CIRCLE" type="CIRCLE_Type"/>
     <xs:element name="POLYGON" type="POLYGON_Type"/>
     <xs:element name="ELLIPSE" type="SIZE_VALUE_Type"/>
    </xs:choice>
   </xs:sequence>
   <xs:attribute name="PADID" type="xs:string" use="required"/>
  </xs:complexType>
 </xs:element>

 <xs:element name="SIMULATOR">
  <xs:complexType>
   <xs:sequence>
    <xs:element name="MODEL_FILE" type="NAME_Type"/>
    <xs:element name="MODEL_FILE_DATE" type="xs:date"/>
    <xs:element name="SIMULATOR_NAME" type="NAME_Type"/>
    <xs:element name="SIMULATOR_VERSION" type="NAME_Type"/>
    <xs:element name="SIMULATOR_COMPLIANCE" type="NAME_Type"/>
    <xs:element name="TERMINAL_OR_GROUP" type="TERMINAL_OR_GROUP_Type"
      minOccurs="0" maxOccurs="unbounded"/>
   </xs:sequence>
   <xs:attribute name="SIMID" type="xs:string" use="required"/>
  </xs:complexType>
 </xs:element>
```

```xml
<xs:element name="FIDUCIAL">
 <xs:complexType>
  <xs:sequence>
   <xs:element name="FIDUCIAL_IDENTIFIER" type="NAME_Type"/>
   <xs:element name="FIDUCIAL_TYPE_NAME">
    <xs:complexType>
     <xs:sequence>
      <xs:element name="FIDUCIAL_TYPE_REF" type="REFERENCE"/>
     </xs:sequence>
    </xs:complexType>
   </xs:element>
   <xs:element name="FIDUCIAL_POSITION" type="POSITION_Type"/>
   <xs:element name="ORIENTATION" type="ORIENTATION_Type"/>
  </xs:sequence>
 </xs:complexType>
</xs:element>

<xs:element name="FIDUCIAL_TYPE">
 <xs:complexType>
  <xs:sequence>
   <xs:element name="FIDUCIAL_FILE" type="DOCUMENT_OR_GRAPHICS_Type"/>
   <xs:element name="FIDUCIAL_SIZE" type="SIZE_VALUE_Type"/>
  </xs:sequence>
  <xs:attribute name="FIDID" type="xs:string" use="required"/>
 </xs:complexType>
</xs:element>

<xs:element name="DEVICES">
 <xs:complexType>
  <xs:sequence>
   <xs:element ref="DEVICE" maxOccurs="unbounded"/>
  </xs:sequence>
 </xs:complexType>
</xs:element>

<xs:element name="DEVICE">
 <xs:complexType>
  <xs:sequence>
   <xs:element name="BLOCK_CREATION_DATE" type="DATE_Type"/>
   <xs:element name="BLOCK_VERSION" type="NAME_Type"/>
   <xs:element name="VERSION" type="NAME_Type"/>
   <xs:element name="DATA_SOURCE" type="ORGANISATION_Type"/>
   <xs:element name="DATA_VERSION" type="NAME_Type"/>
   <xs:element name="DEVICE_FORM" type="DEVICE_FORM_Type"/>
   <xs:element name="DIE_NAME" type="NAME_Type"/>
   <xs:element name="DIE_MASK_REVISION" type="xs:string" minOccurs="0"/>
   <xs:element name="MANUFACTURERS" type="MANUFACTURERS_Type"/>
   <xs:element name="SUPPLIER" type="ORGANISATION_Type" minOccurs="0"/>
   <xs:element name="TYPE_NUMBER" type="NAME_Type"/>
   <xs:element name="PACKAGED_PART_NAME" type="NAME_Type" minOccurs="0"/>
   <xs:element name="FUNCTION" type="xs:string"/>
   <xs:element name="DIMENSIONS" type="DIE_DIMENSIONS_Type"/>
   <xs:element name="DIE_PICTURE" type="DOCUMENT_OR_GRAPHICS_Type"
     minOccurs="0" maxOccurs="unbounded"/>
   <xs:element name="DEVICE_DATA_FILE" type="DOCUMENT_OR_GRAPHICS_Type"
     minOccurs="0" maxOccurs="unbounded"/>
   <xs:element name="MATERIALS" type="MATERIAL_Type"/>
   <xs:element name="BUMP_DATA" type="BUMP_DATA_Type" minOccurs="0"/>
   <xs:element name="MPD_DATA" type="MPD_DATA_Type" minOccurs="0"/>
   <xs:element name="RATINGS" type="RATING_Type" minOccurs="0"/>
   <xs:element name="DIE_DELIVERY_FORM" type="LIST_Type" minOccurs="0"/>
   <xs:element name="PACKING_CODE" type="xs:string" minOccurs="0"/>
   <xs:element name="WAFER_DATA" type="WAFER_Type" minOccurs="0"/>
   <xs:element name="SUBSTRATE_CONNECTION"
     type="SUBSTRATE_CONNECTION_Type"/>
   <xs:element name="TERMINAL_TYPES">
    <xs:complexType
```

```
   <xs:sequence>
    <xs:element name="TERMINAL_TYPE_COUNT" type="COUNT_Type"/>
    <xs:element ref="TERMINAL_TYPE" maxOccurs="unbounded"/>
   </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:element name="TERMINALS">
  <xs:complexType>
   <xs:sequence>
    <xs:element name="TERMINAL_COUNT" type="COUNT_Type"/>
    <xs:element ref="TERMINAL" maxOccurs="unbounded"/>
   </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:element name="TERMINAL_GROUPS" minOccurs="0">
  <xs:complexType>
   <xs:sequence>
    <xs:element ref="TERMINAL_GROUP" maxOccurs="unbounded"/>
   </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:element name="PERMUTABLE" type="PERMUTABLE_Type" minOccurs="0"
   maxOccurs="unbounded"/>
 <xs:element name="SIMULATORS" minOccurs="0">
  <xs:complexType>
   <xs:sequence>
    <xs:element ref="SIMULATOR" maxOccurs="unbounded"/>
   </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:element name="FIDUCIAL_TYPES" minOccurs="0">
  <xs:complexType>
   <xs:sequence>
    <xs:element ref="FIDUCIAL_TYPE" maxOccurs="unbounded"/>
   </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:element name="FIDUCIALS" minOccurs="0">
  <xs:complexType>
   <xs:sequence>
    <xs:element ref="FIDUCIAL" maxOccurs="unbounded"/>
   </xs:sequence>
  </xs:complexType>
 </xs:element>
 <xs:element name="QUALITY" type="QUALITY_Type"/>
 <xs:element name="RELIABILITY" type="RELIABILITY_Type"/>
 <xs:element name="ASSEMBLY_AND_STORAGE"
   type="ASSEMBLY_AND_STORAGE_Type" minOccurs="0"/>
 </xs:sequence>
 <xs:attribute name="NAME" type="xs:string" use="required"/>
 <xs:attribute name="TYPE" type="xs:string" use="required"/>
</xs:complexType>
```

```
<!-- Key declarations -->

  <xs:key name="TERMINAL_Key">
   <xs:selector xpath=".//TERMINAL"/>
   <xs:field xpath="@TERMID"/>
  </xs:key>
  <xs:keyref name="TERMINAL_KeyRef" refer="TERMINAL_Key">
   <xs:selector xpath=".//TERMINAL_REF"/>
   <xs:field xpath="@REF"/>
  </xs:keyref>
  <xs:key name="TERMINAL_TYPE_Key">
   <xs:selector xpath=".//TERMINAL_TYPE"/>
   <xs:field xpath="@PADID"/>
  </xs:key>
  <xs:keyref name="TERMINAL_TYPE_KeyRef" refer="TERMINAL_TYPE_Key">
   <xs:selector xpath=".//TERMINAL_TYPE_REF"/>
   <xs:field xpath="@REF"/>
  </xs:keyref>
  <xs:key name="TERMINAL_GROUP_Key">
   <xs:selector xpath=".//TERMINAL_GROUP"/>
   <xs:field xpath="@GROUPID"/>
  </xs:key>
  <xs:keyref name="TERMINAL_GROUP_KeyRef" refer="TERMINAL_GROUP_Key">
   <xs:selector xpath=".//TERMINAL_GROUP_REF"/>
   <xs:field xpath="@REF"/>
  </xs:keyref>
  <xs:key name="SIMULATOR_Key">
   <xs:selector xpath=".//SIMULATOR"/>
   <xs:field xpath="@SIMID"/>
  </xs:key>
  <xs:keyref name="SIMULATOR_KeyRef" refer="SIMULATOR_Key">
   <xs:selector xpath=".//SIMULATOR_REF"/>
   <xs:field xpath="@REF"/>
  </xs:keyref>
  <xs:key name="FIDUCIAL_TYPE_Key">
   <xs:selector xpath=".//FIDUCIAL_TYPE"/>
   <xs:field xpath="@FIDID"/>
  </xs:key>
  <xs:keyref name="FIDUCIAL_TYPE_KeyRef" refer="FIDUCIAL_TYPE_Key">
   <xs:selector xpath=".//FIDUCIAL_TYPE_REF"/>
   <xs:field xpath="@REF"/>
  </xs:keyref>
 </xs:element>

</xs:schema>
```

Annex B
(informative)

XML example

Annex B is based on a fictitious example for a quad two-input NAND gate and illustrates many of the features of the schema.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<DEVICES xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="DDXschema.xsd">
  <DEVICE NAME = "74ACT00" TYPE = "bare_die">
    <BLOCK_CREATION_DATE>2006-02-13</BLOCK_CREATION_DATE>
    <BLOCK_VERSION>DDXconvert version 4.0</BLOCK_VERSION>
    <VERSION>1.2</VERSION>
    <DATA_SOURCE>
      <NAME>GOOD-DIE database</NAME>
    </DATA_SOURCE>
    <DATA_VERSION>Initial issue A</DATA_VERSION>
    <DEVICE_FORM>bare_die</DEVICE_FORM>
    <DIE_NAME>74ACT00</DIE_NAME>
    <DIE_MASK_REVISION>Mask T</DIE_MASK_REVISION>
    <MANUFACTURERS>
      <MANUFACTURER>
        <NAME>Fuzziwuzz Logic Ltd</NAME>
      </MANUFACTURER>
    </MANUFACTURERS>
    <TYPE_NUMBER>74ACT00</TYPE_NUMBER>
    <FUNCTION>Quad two-input advanced CMOS NAND gate</FUNCTION>
    <DIMENSIONS>
      <GEOMETRIC_UNITS>micrometre</GEOMETRIC_UNITS>
      <GEOMETRIC_ORIGIN X = "0" Y = "0" />
      <GEOMETRIC_VIEW>top</GEOMETRIC_VIEW>
      <DIE_SIZE X_SIZE = "1067" Y_SIZE = "1143" />
      <DIE_THICKNESS>356</DIE_THICKNESS>
      <LENGTH_TOLERANCE NEG="-20" POS="20"/>
      <WIDTH_TOLERANCE NEG="-20" POS="20"/>
      <THICKNESS_TOLERANCE NEG="-10" POS="10"/>
      <TERMINAL_X_POSITION_TOLERANCE NEG="-5" POS="5"/>
      <TERMINAL_Y_POSITION_TOLERANCE NEG="-5" POS="5"/>
    </DIMENSIONS>
    <MATERIALS>
      <TECHNOLOGY>CMOS</TECHNOLOGY>
      <SEMICONDUCTOR_MATERIAL>silicon</SEMICONDUCTOR_MATERIAL>
      <METALLISATION>Al</METALLISATION>
    </MATERIALS>
    <RATINGS>
      <MAX_TEMP>175</MAX_TEMP>
      <TEMPERATURE_RANGE MIN="-70" MAX="150"/>
    </RATINGS>
    <DIE_DELIVERY_FORM>Die, wafer</DIE_DELIVERY_FORM>
    <WAFER_DATA>
      <WAFER_SIZE DIAMETER="8" UNITS="inch"></WAFER_SIZE>
      <WAFER_THICKNESS>356</WAFER_THICKNESS>
      <WAFER_INDEX ORIENTATION="90" INDEX="flat"></WAFER_INDEX>
    </WAFER_DATA>
    <SUBSTRATE_CONNECTION>
      <REQUIREMENT>CONN</REQUIREMENT>
      <CONNECTED_TO>Vcc</CONNECTED_TO>
    </SUBSTRATE_CONNECTION>
    <TERMINAL_TYPES>
      <TERMINAL_TYPE_COUNT>1</TERMINAL_TYPE_COUNT>
        <TERMINAL_TYPE PADID = "PADR1" >
          <TERMINAL_TYPE_NAME>PADR1</TERMINAL_TYPE_NAME>
```

```
        <RECTANGLE X_SIZE = "97" Y_SIZE = "97" />
      </TERMINAL_TYPE>
  </TERMINAL_TYPES>
  <TERMINALS>
  <TERMINAL_COUNT>28</TERMINAL_COUNT>
    <TERMINAL TERMID = "T_1" >
      <TERMINAL_IDENTIFIER>T_1</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>1</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "-385" Y = "422" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>A1</SIGNAL_NAME>
      <SIGNAL_TYPE>I</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_2" >
      <TERMINAL_IDENTIFIER>T_2</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>2</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "-385" Y = "176" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>B1</SIGNAL_NAME>
      <SIGNAL_TYPE>I</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_3" >
      <TERMINAL_IDENTIFIER>T_3</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>3</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "-385" Y = "11" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>Y1</SIGNAL_NAME>
      <SIGNAL_TYPE>O</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_4" >
      <TERMINAL_IDENTIFIER>T_4</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>4</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "-385" Y = "-236" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>A2</SIGNAL_NAME>
      <SIGNAL_TYPE>I</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_5" >
      <TERMINAL_IDENTIFIER>T_5</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>5</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "-208" Y = "-423" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>B2</SIGNAL_NAME>
      <SIGNAL_TYPE>I</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_6" >
      <TERMINAL_IDENTIFIER>T_6</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>6</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "-43" Y = "-423" />
```

```
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>Y2</SIGNAL_NAME>
      <SIGNAL_TYPE>O</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_7" >
      <TERMINAL_IDENTIFIER>T_7</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>7</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "123" Y = "-423" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>GND</SIGNAL_NAME>
      <SIGNAL_TYPE>G</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_8" >
      <TERMINAL_IDENTIFIER>T_8</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>8</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "385" Y = "-423" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>Y3</SIGNAL_NAME>
      <SIGNAL_TYPE>O</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_9" >
      <TERMINAL_IDENTIFIER>T_9</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>9</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "385" Y = "-166" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>B3</SIGNAL_NAME>
      <SIGNAL_TYPE>I</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_10" >
      <TERMINAL_IDENTIFIER>T_10</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>10</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "385" Y = "-1" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>A3</SIGNAL_NAME>
      <SIGNAL_TYPE>I</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_11" >
      <TERMINAL_IDENTIFIER>T_11</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>11</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "385" Y = "164" />
        <ORIENTATION ANGLE = "0" />
      <SIGNAL_NAME>Y4</SIGNAL_NAME>
      <SIGNAL_TYPE>O</SIGNAL_TYPE>
    </TERMINAL>
    <TERMINAL TERMID = "T_12" >
      <TERMINAL_IDENTIFIER>T_12</TERMINAL_IDENTIFIER>
      <TERMINAL_NUMBER>12</TERMINAL_NUMBER>
      <TERMINAL_TYPE_NAME>
        <TERMINAL_TYPE_REF REF = "PADR1" />
      </TERMINAL_TYPE_NAME>
      <TERMINAL_POSITION X = "385" Y = "423" />
        <ORIENTATION ANGLE = "0" />
```

```
        <SIGNAL_NAME>B4</SIGNAL_NAME>
        <SIGNAL_TYPE>I</SIGNAL_TYPE>
      </TERMINAL>
      <TERMINAL TERMID = "T_13" >
        <TERMINAL_IDENTIFIER>T_13</TERMINAL_IDENTIFIER>
        <TERMINAL_NUMBER>13</TERMINAL_NUMBER>
        <TERMINAL_TYPE_NAME>
          <TERMINAL_TYPE_REF REF = "PADR1" />
        </TERMINAL_TYPE_NAME>
        <TERMINAL_POSITION X = "38" Y = "423" />
          <ORIENTATION ANGLE = "0" />
        <SIGNAL_NAME>A4</SIGNAL_NAME>
        <SIGNAL_TYPE>I</SIGNAL_TYPE>
      </TERMINAL>
      <TERMINAL TERMID = "T_14" >
        <TERMINAL_IDENTIFIER>T_14</TERMINAL_IDENTIFIER>
        <TERMINAL_NUMBER>14</TERMINAL_NUMBER>
        <TERMINAL_TYPE_NAME>
          <TERMINAL_TYPE_REF REF = "PADR1" />
        </TERMINAL_TYPE_NAME>
        <TERMINAL_POSITION X = "-129" Y = "423" />
          <ORIENTATION ANGLE = "0" />
        <SIGNAL_NAME>VCC</SIGNAL_NAME>
        <SIGNAL_TYPE>V</SIGNAL_TYPE>
      </TERMINAL>
    </TERMINALS>
      <TERMINAL_GROUPS>
        <TERMINAL_GROUP GROUPID="G_1">
          <GROUP_NAME>G_1</GROUP_NAME>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_1"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_2"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
        </TERMINAL_GROUP>
        <TERMINAL_GROUP GROUPID="G_2">
          <GROUP_NAME>G_2</GROUP_NAME>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_4"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_5"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
        </TERMINAL_GROUP>
        <TERMINAL_GROUP GROUPID="G_3">
          <GROUP_NAME>G_3</GROUP_NAME>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_9"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_10"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
        </TERMINAL_GROUP>
        <TERMINAL_GROUP GROUPID="G_4">
          <GROUP_NAME>G_4</GROUP_NAME>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_12"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_13"></TERMINAL_REF>
          </TERMINAL_OR_GROUP>
        </TERMINAL_GROUP>
        <TERMINAL_GROUP GROUPID="G_5">
          <GROUP_NAME>G_5</GROUP_NAME>
          <TERMINAL_OR_GROUP>
            <TERMINAL_REF REF="T_3"></TERMINAL_REF>
```