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Data requirements for semiconductor die -- Part 3: Mechanical, material and connectivity requirements

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ES 59008-3

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English version

Data requirements for semiconductor die
Part 3: Mechanical, material and connectivity requirements

This European Specification was approved by CENELEC on 1999-06-29.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. ES 59008-3:1999 E

Foreword

This European Specification has been prepared by the CENELEC BTTF 97-1, Known good die.

It was submitted to the vote during the meeting of BTTF 97-1 and approved by CENELEC as ES 59008-3 on 1999-06-29.

The following dates was fixed:

- latest date by which the existence of the ES has to be announced at national level (doa) 1999-11-01

The structure of this European Specification is as follows.

ES 59008 Data requirements for semiconductor die
- Part 1 General requirements
- Part 2 Vocabulary
- Part 3 Mechanical, material and connectivity requirements
- Part 4 Specific requirements and recommendations
  - Part 4-1: Test and quality
  - Part 4-2: Handling and storage
  - Part 4-3: Thermal
  - Part 4-4: Electrical simulation
- Part 5 Particular requirements and recommendations for die types
  - Part 5-1: Bare die
  - Part 5-2: Bare die with added connection structures
  - Part 5-3: Minimally-packaged die
- Part 6 Exchange data formats and data dictionary
  - Part 6-1: Data exchange - DDX file format
  - Part 6-2: Data dictionary

Introduction

This European Specification has been developed to facilitate the selection of unpackaged and minimally-packaged semiconductor die, with or without connection structures in order to save both design and procurement time.

It is a data specification which defines the requirements for :

- product identity
- product data
- die mechanical information
- test, quality and reliability information
- handling, storage and mounting information
- thermal data and electrical simulation data.

This document was prepared by CENELEC Task Force CLC/BTTF 97-1 Known Good Die. Other organisations that helped prepare it were: the ESPRIT GOOD-DIE projects, EECA, Sematech, DPC and EIAJ.

The specification was derived from the work carried out in the ESPRIT 4th Framework project GOOD-DIE. This project was set up to develop a database for the selection of unpackaged and minimally-packaged semiconductor die, with or without connection structures, and for the downloading of information to CAD design stations to facilitate the layout and simulation of MCMs and hybrid circuits. During the early part of the GOOD-DIE project the need was identified for a standard way of presenting information for the selection and procurement of these components.

1 Scope

This European Specification specifies requirements for the exchange of data pertaining to bare semiconductor die, with or without connection structures, and minimally-packaged semiconductor die.

This specification also gives recommendations on the information requirements for general industry good practice to facilitate the acceptance and use of bare die, with or without connection structures, and minimally-packaged die.

ES 59008-3 specifies the basic requirements for the data which are needed to describe the geometrical properties of die, their physical properties and the electrical connection necessary for their use in the development and manufacture of products.

More detailed requirements concerning handling, test, thermal properties and simulation models are contained in ES 59008-4 whilst requirements specific to different die types are contained in ES 59008-5.

ES 59008-3 should be read in conjunction with ES 59008-1: General requirements.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ES 59008.

ES 59008-1, *Data requirements for semiconductor die -- Part 1: General requirements*

ES 59008-2, *Data requirements for semiconductor die -- Part 2: Vocabulary*

ES 59008-4, *Data requirements for semiconductor die -- Part 4: Specific requirements and recommendations*

ES 59008-5, *Data requirements for semiconductor die -- Part 5: Particular requirements and recommendations for die types*

ES 59008-6-1, *Data requirements for semiconductor die -- Part 6-2: Exchange data formats and data dictionary – Data exchange - DDX*

ES 59008-6-2, *Data requirements for semiconductor die -- Part 6-3: Exchange data formats and data dictionary – Data dictionary*

IEC 60191, *Mechanical standardisation of semiconductor devices*

IEC 61360-1:1995, *Standard data element types with associated classification scheme for electric components -- Part 1: Definitions - Principles and methods.*

EIA/JESD30-B, *Descriptive designation for semiconductor-device packages*

EIA/JEP95, *JEDEC registered and standard outlines for solid-state and related products*

BS 3934, *Mechanical standardisation of semiconductor devices*

3 Definitions

For the purpose of this European Specification, the definitions given in ES 59008-2 apply.

4 Availability of information and conformity

4.1 Publication of data

Whilst it is expected that much of the information supplied in conformance with this European Specification will be in the public domain and available from such sources as manufacturers' data sheets, this specification does not place 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.

4.2 Conformity levels

When any data are supplied which claim conformity to this specification, the level of conformity shall be stated as follows :

Level 1: all data listed in **6.1** and/or **7.1** have been included.

Level 2: all data listed in **6.1**, **6.2** and/or **7.1** and **7.2** have been included.

Level 3: all data listed in **6.1, 6.2, 6.3** and/or **7.1** and **7.2** have been included

5 Data exchange

All data intended for exchange by electronic means shall be formatted in accordance with the provisions of ES 59008-6-1 and ES 59008-6-2 and of IEC 61360-1.

6 Requirements for bare die

This clause covers the requirements for bare die with and without connection structures. However, since not all requirements are applicable to all types of die, Table 1 summarises the requirements in the first three columns where the figure shows the level of the conformity level for each die type.

6.1 Essential information

In order to claim conformity with any of the levels 1, 2 or 3 all the information covered by the subclauses under 6.1 shall be given as indicated by a figure 1 in the relevant column of Table 1.

6.1.1 Die form

The physical form in which the die is/are supplied, whether bare die, bumped die, die with lead frame or minimally-packaged die.

6.1.2 Die name (mask name)

The name given by the manufacturer to identify the die which is generally physically shown on the die.

6.1.3 Die version

The revision or step code to identify the mask versions used in production of the die

6.1.4 Die manufacturer

The identity of the firm responsible for manufacture of the die.

6.1.5 Type number (manufacturer part number)

The type number given by the manufacturer to identify the finished die as supplied to the customer.

6.1.6 Function

Basic description of the electrical function performed by the device.

6.1.7 Units of measurement

The units in which dimensions are given.

6.1.8 Die size

The length and width of the die.

a) for bare die these are the nominal dimensions after sawing

NOTE If these are not available, the step-and repeat dimensions shall be given.

b) for wafers these are the nominal step-and-repeat dimensions

6.1.9 Die thickness

The thickness of the finished die.

6.1.10 Geometric origin

Coordinates of a reference position on the die, with respect to the geometric centre of the die surface, which forms the origin of the coordinate system with respect to which the position of die features, such as pad positions, are referenced. The preferred reference position is at the geometric centre of the die.

6.1.11 Geometric view

A statement as to whether the die is viewed from the top (active side upwards) or bottom (active side downwards). The preferred view is from the top.

6.1.12 Pad count

The number of separate bond pads on the die.

6.1.13 Pad information

For each pad on the die, the following information:

a) **position** - the coordinates of the geometric centre of the pad with respect to the geometric origin,

b) **shape** - the shape and associated dimensions of the pad at that position,

c) **orientation** - the orientation of the pad with respect to a reference direction on the die,

d) **signal name** - the name of the signal or supply connection made to the pad.

6.1.14 Die information source

The identity of the organisation or individual responsible for creating the die data set.

6.1.15 File creation date

The date of creation of the die data set.

6.1.16 File version

The version of the die data set.

6.2 Desirable information

The information covered by this subclause is important and should be supplied if at all possible. In order to claim conformity with either level 2 or 3 all the information covered by the subclauses under 6.1 and 6.2 shall be given as indicated by a figure 1 or 2 in the relevant column of Table 1.

6.2.1 Die substrate material

The semiconductor material which forms the bulk of the die material.

6.2.2 Substrate electrical connection

Any requirements on electrical connection to the substrate of the die to ensure that the material is correctly biased. Where this information is given it shall be made clear whether a substrate connection is obligatory, is optional or is forbidden.

6.2.3 Die technology

The technology of manufacture of the semiconductor device, for example CMOS, BiCMOS, bipolar etc.

6.2.4 Power dissipation

The power dissipation within the die under stated normal operating conditions.

NOTE If figures for both typical and maximum power dissipation are available, both should be given.

6.2.5 Junction temperature

The range of operating temperature of the semiconducting junctions within the die for which the device will operate correctly according to its published specifications.

6.2.6 Die picture

A drawing or photograph of the die which shows the relative positions of the pads, bumps or lead frame connections.

6.2.7 Signal type

The type of signal or supply connection to a pad (input, output, supply voltage, no connect etc.).

6.2.8 Wafer size

The size of the wafer on which the die was fabricated. If the die is supplied in wafer form, this information shall be given.

6.2.9 Wafer map

Where die are supplied in the form of a tested wafer, a wafer map showing results from the test.

Alternatively, the wafer itself may be marked, for example by inking individual die, in which case a corresponding statement should be made as to the meaning of the marks.

6.2.10 Form of supply

The form in which the die is supplied, either as individual die, as sawn wafers or as unsawn wafers.

6.2.11 Packing for shipment

The form of external packing used to protect the die or wafers during shipment, for example waffle pack, tape-and-reel, wafer jar or other container.

6.3 Optional information

The information covered by this subclause should be supplied whenever it is applicable and available. In order to claim conformity with level 3 all the information covered by the subclauses under 6.1, 6.2 and 6.3 shall be given as indicated by a figure 1, 2 or 3 in the relevant column of Table 1.

6.3.1 Supplier

The identity of the supplier of the die when this is different from the original manufacturer.

6.3.2 Wafer fabricator

The location of the wafer fabricator where this is different from the location of the nominal manufacturer.

6.3.3 Dimension tolerances

Tolerances for die dimensions, die thickness, pad dimensions and pad positions.

6.3.4 Passivation material

The material used in the final passivation layer on the surface of the die for protection and insulation.

6.3.5 Pad metallization

The material used for the metallization of the bonding pads on the die.

6.3.6 Backside finish

Details of any surface finish and plating applied to the backside of a die.

6.3.7 Bump material

For bumped die, the material used in forming the bumps.