

INTERNATIONAL STANDARD

IEC
60286-5

Second edition
2003-10

Packaging of components for automatic handling –

Part 5: Matrix trays

*Emballage de composants pour
opérations automatisées –*

*Partie 5:
Supports matriciels*



Reference number
IEC 60286-5:2003(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications (www.iec.ch/online_news/justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC
60286-5

Second edition
2003-10

Packaging of components for automatic handling –

Part 5: Matrix trays

*Emballage de composants pour
opérations automatisées –*

*Partie 5:
Supports matriciels*

© IEC 2003 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

U

For price, see current catalogue

CONTENTS

FOREWORD	4
1 Scope	6
2 Material	6
2.1 Electrostatic dissipative requirements	6
2.2 Effect of properties	6
2.3 Recycling and rigidity	6
3 Mechanical stability	6
3.1 Loaded tray	6
3.2 Empty tray	6
3.3 Outer edges	7
4 Tray design, dimensions and other physical properties	7
4.1 Tray design	7
4.1.1 Number of pockets	7
4.1.2 Orientation of pockets	7
4.1.3 Design rules for pocket density	7
4.2 Overall tray dimensions	8
4.3 Cell dimensions	8
4.4 Tray vacuum pick-up sites	10
4.4.1 Size	10
4.4.2 Centre	10
4.4.3 Perimeter	10
4.5 Detail features	10
4.6 Weight	10
4.7 Movement of components	10
4.8 Dimensional information	11
5 Polarity and orientation of components in the tray	14
5.1 Pin one	14
5.2 Loading	14
6 Tray stacking	14
6.1 Bundling	14
6.2 Top protection	14
6.3 Partial filling	14
6.4 Protrusion of components	14
6.5 Stack-up	14
6.6 Damaging of components	14
7 Missing components	14
8 Marking	15
Annex A (informative) List of existing matrix trays with wide anticipated use in the electronic industries	16

Figure 1 – Sample of leaded packages.....	9
Figure 2 – Sample of grid array packages	9
Figure 3 – Tray main view	11
Figure 4 – Tray stacking details	12
Figure A.1 – Thin tray.....	17
Figure A.2 – Thick matrix	25
Table 1 – Height dimensions	8
Table A.1 – Variations.....	19
Table A.2 – PGA variations	27

IECNORM.COM: Click to view the full PDF of IEC 60286-5:2003

Without watermark

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 5: Matrix trays

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60286-5 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This second edition cancels and replaces the first edition published in 1995 and constitutes a technical revision.

This edition includes the following significant technical changes from the previous edition.

- a) The generic rules for the design of matrix trays are given in this standard. Newly developed trays which follow these rules will not be listed individually. Only those trays which conform to the design rules set forth herein are classified as "standard trays" and are thus preferred for use.
- b) An update of the matrix trays, which do not conform to the design rules set forth herein, are considered as "non-standard trays" and are not preferred for use, is listed in Annex A.

The text of this standard is based on the following documents:

FDIS	Report on voting
40/1341/FDIS	40/1364/RVD

Full information on the voting for the approval of this standard 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.

The committee has decided that the contents of this publication will remain unchanged until 2005. 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.

PACKAGING OF COMPONENTS FOR AUTOMATIC HANDLING –

Part 5: Matrix trays

1 Scope

This part of IEC 60286 describes the common dimensions, tolerances and characteristics of the tray. It includes only those dimensions which are essential for the handling of the trays for the stated purpose and for placing or removing components from the trays.

Matrix trays are designed to facilitate the transport and handling of electronic components during their testing, baking, transport/storage, and final mounting by automatic placement equipment.

The generic rules for their design are given in this standard. Newly developed trays which follow these rules will not be listed individually. Only those trays which conform to the design rules set forth herein are classified as “standard trays” and are thus preferred for use.

NOTE Matrix trays listed in Annex A which do not conform to the design rules set forth herein shall be considered as “non-standard trays” and are not preferred for use.

2 Material

2.1 Electrostatic dissipative requirements

Trays shall be moulded from material that meets the ESD dissipative requirements which are: equal to, or greater than, $1,0 \times 10^5$ ohms/square but less than $1,0 \times 10^{12}$ ohms/square.

2.2 Effect of properties

The tray material shall not adversely affect the mechanical, electrical characteristics, solderability, or marking of the component during or after transport, baking or storage in the tray.

2.3 Recycling and rigidity

The tray material shall be reusable or recyclable and shall be rigid enough to avoid damage to the components during handling, loading, baking, testing, shipping and placement operations.

There should be space for a recycle logo and material code or material declaration close to ‘Detail B’.

3 Mechanical stability

3.1 Loaded tray

Mechanical stability of loaded trays shall be such that the components are adequately retained, without lead damage, and can be easily removed from the tray.

3.2 Empty tray

The empty tray shall withstand normal environmental conditions (including component baking temperatures, if required) without distorting, warping, expanding, shrinking or any other physical change outside the specified dimensions of the trays.

3.3 Outer edges

The outer edges of the tray shall be of sufficient thickness and strength to allow mechanical positioning and clamping.

4 Tray design, dimensions and other physical properties

4.1 Tray design

4.1.1 Number of pockets

All new tray proposals should maximize the number of pockets in each tray-family variation without violating the pocket-density design rules specified in 4.1.3.

4.1.2 Orientation of pockets

When designing a tray for a rectangular package, the longest dimension (D) of the package is oriented parallel to the length of the tray to maximize tray pocket density.

4.1.3 Design rules for pocket density

4.1.3.1 Formulas

- DT is $D_{\max}$ + strengthening pocket rib width W
 ET is $E_{\max}$ + strengthening pocket rib width W
 M is $(135,9 \text{ mm} - M3(N1 - 1))/2$
 $M1$ is $(315,0 \text{ mm} - M2(N2 - 1))/2$
 $M2$ is $[(315,0 \text{ mm} - 6,4 \text{ mm}) - W(N2 - 1)]/N2 + W$
 $M3$ is $[(135,9 \text{ mm} - 6,4 \text{ mm}) - W(N1 - 1)]/N1 + W$
 $N1$ is $(135,9 \text{ mm} - 6,4 \text{ mm})/ET$ (rounded down to a whole number)
 $N2$ is $(315,0 \text{ mm} - 6,4 \text{ mm})/DT$ (rounded down to a whole number)

NOTE After the maximum matrix has been established by the above calculation using a minimum W value, $N1$ and $N2$ may not have resulted in even numbers and may therefore have been rounded down to the nearest whole number. This means we may have fractions of millimetres extra that should be added back to $M2$ and $M3$ to maximize the pitch between the pockets while minimizing the edge of the tray to the centre line of the first pocket M and $M1$.

4.1.3.2 Constituents of the design rules, formulas and drawings

- $D_{\max}$ is determined by appropriate specification
 DT is the max. length D + strengthening pocket rib width W
 $E_{\max}$ is determined by appropriate specification
 ET is the max. width E + strengthening pocket rib width W
 M is the edge of the tray width to the centre line of the first pocket
 $M1$ is the edge of the tray length to the centre line of the first pocket
 $M2$ is the pitch of the tray pocket in the tray length
 $M3$ is the pitch of the tray pocket in the tray width
 N is the package lead counts supported
 $N1$ is the number of columns in the tray
 $N2$ is the number of rows in the tray
 $N3$ is the total number of pockets in the tray ($N1 \times N2 = N3$)

- $N4$ is the package type accommodated
 $N5$ is the end vacuum pick-up area(s)
 $N6$ is the centre vacuum pick-up area(s)
 W is the strengthening pocket rib width

NOTE The tray sponsor will determine W from the latest manufacturing capabilities and design feature needs at the time of the new tray-family design.

W should not exceed the target value of 2,00 mm in order to achieve the maximum tray density unless required by application.

4.2 Overall tray dimensions

Overall tray dimensions shall be 322,6 mm in length and 135,9 mm in width. Overall height A , stacking step height $A1$ and edge height $A2$ are given in Table 1.

Table 1 – Height dimensions

Dimension	Thin tray mm	Thick tray mm
A	7,62	12,19
$A1$	6,35	10,16
$A2$	1,27 typically	2,00 typically

4.3 Cell dimensions

Cell dimensions are derived from package dimensions. The information given in this section is intended for reference only. Package types shown in Figures 1 and 2 are not intended in any way to limit types of present or future designs which may require matrix trays.

D and E dimensions represent the largest overall features of a package (lead or body).

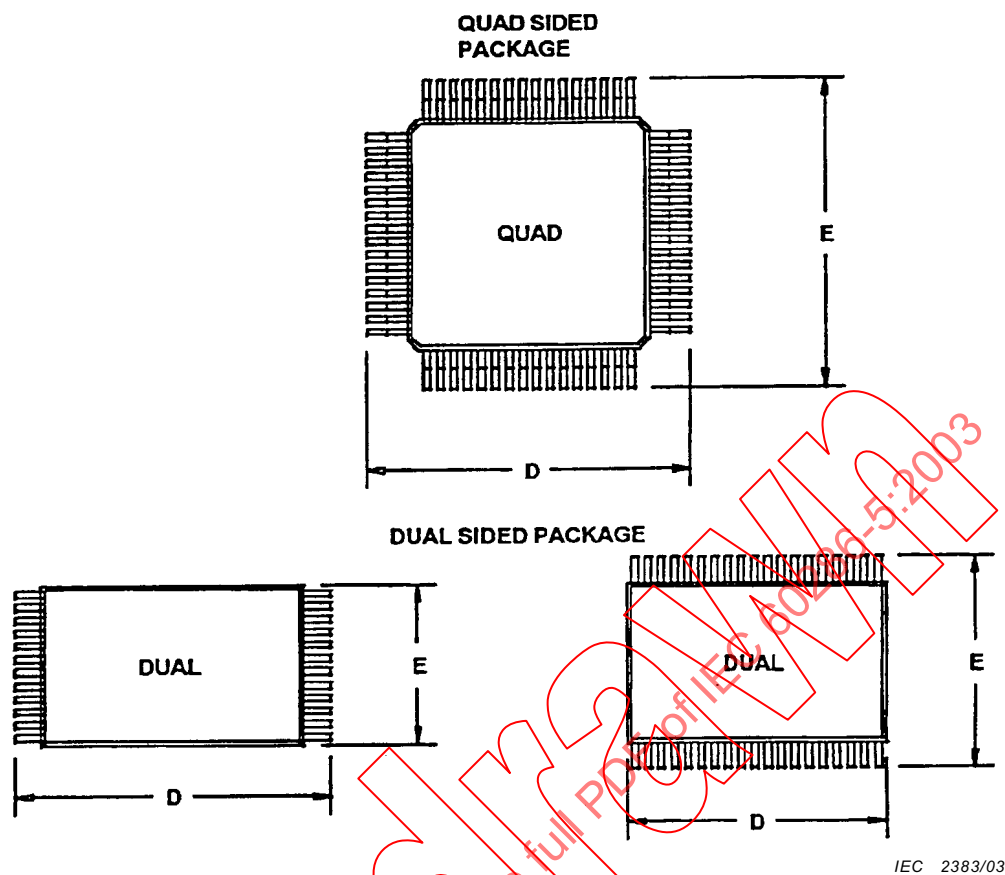


Figure 1 – Sample of leaded packages

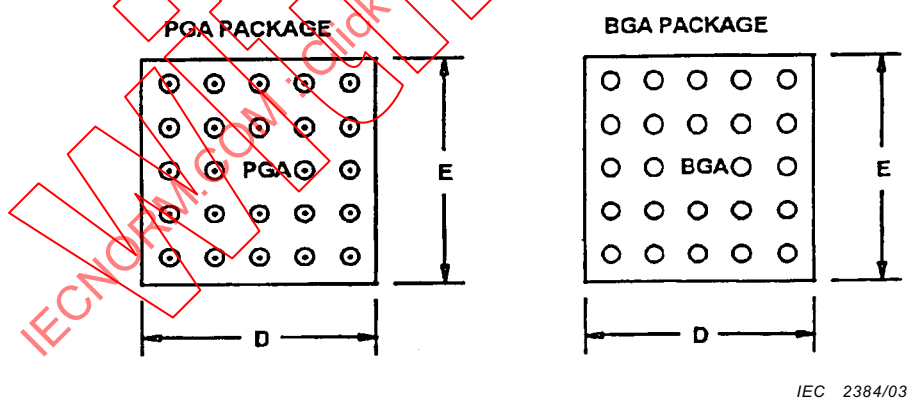


Figure 2 – Sample of grid array packages

4.4 Tray vacuum pick-up sites

4.4.1 Size

The closed walled vacuum pick-up area should be at least 28 mm × 28 mm.

4.4.2 Centre

A minimum of one walled vacuum pick-up area should be located as close to the centre as possible.

4.4.3 Perimeter

A minimum of one perimeter vacuum pick-up area should be located at each end of the tray.

4.5 Detail features

All cavity detail features must begin at a minimum distance of 3,2 mm from the external end of the tray (see Figures 3 and 4).

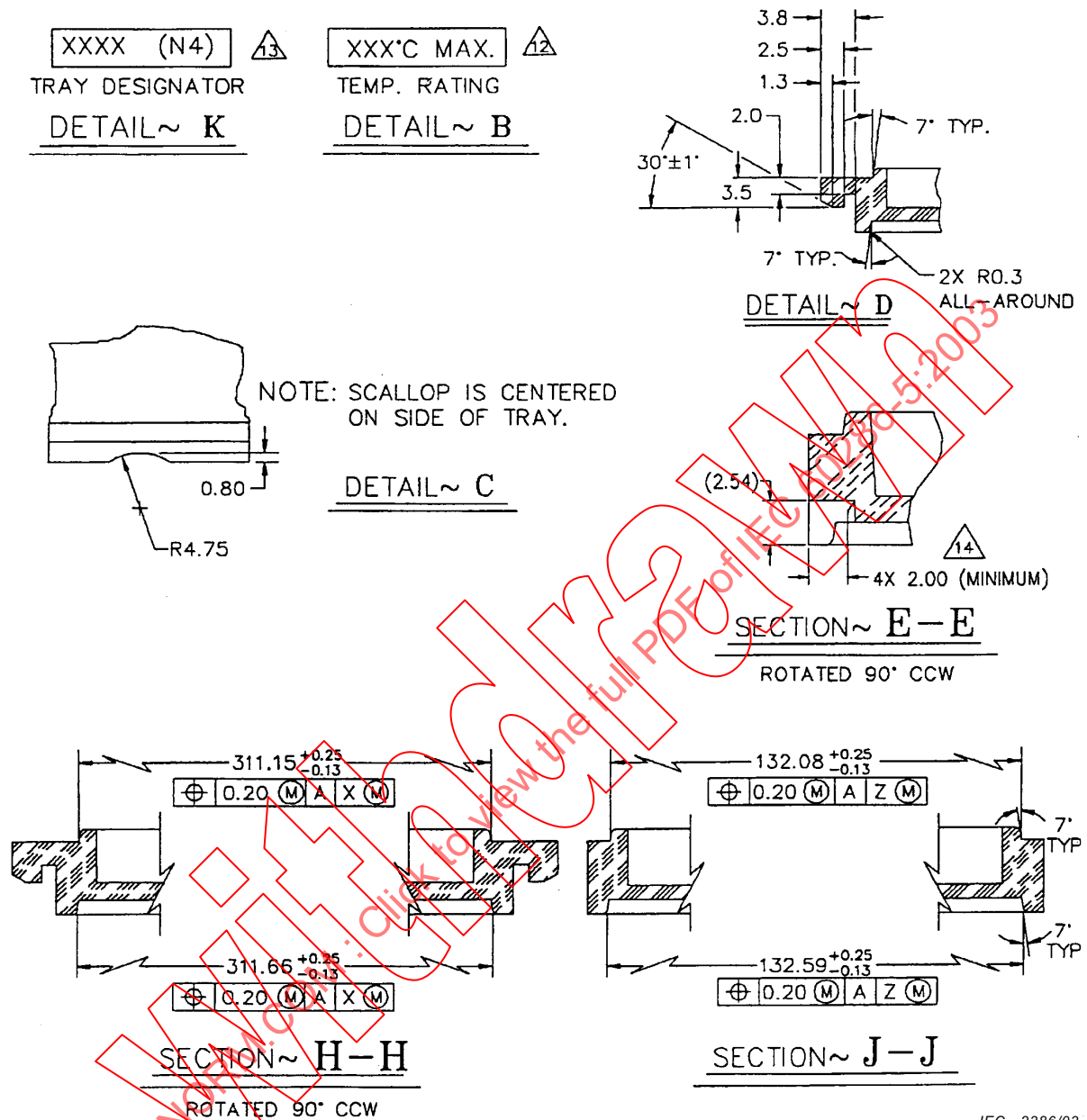
NOTE The straightness call-out of 0,80 mm may have to be reduced when designing trays for thinner packages.

4.6 Weight

The empty tray weight shall not exceed 300 g.

4.7 Movement of components

The tray cell design shall minimize the component movement. The component shall not rotate more than 2,5° in any direction.



NOTE For notes, see page 13.

IEC 2386/03

Figure 4 – Tray stacking details

Notes related to Figures 3 and 4

1	These surfaces should be free of seams.
2	Chamfer denotes package pin 1 orientation.
3	The tray vacuum pick-up method requires two separate pick-up areas represented by bottom closed cells. Optional vacuum pick-up cell locations are N5.
4	The tray vacuum pick-up method requires a minimum walled pick-up area of 28 mm × 28 mm, located as close to the centre of the tray as is practical. Centre vacuum pick-up cell locations are N6.
5	This scallop is centred on the side of the tray and allows the use of a pin to bias mechanically the tray orientation.
6	The symbol <i>N</i> refers to package lead count supported, where applicable.
7	Total usable cells $N3 = N1 \times N2$ (columns × rows). Columns run top to bottom along the length of the tray. Rows run left to right across the width of the tray.
8	Dimensions <i>M</i> , <i>M1</i> , <i>M2</i> and <i>M3</i> define the centre lines for the cell sites. Package interface is controlled by package design and lead form.
9	Non-tabulated dimensions have a tolerance of
	X = ± 0,25;
	XX = ± 0,13; angles = ± 0,5°.
10	Dimensions are in millimetres.
11	Interpret dimensioning and tolerancing in accordance with ANSI Y14.5M-1982.
12	XXX °C is the maximum temperature to which the empty tray can be subjected to for 48 continuous hours without violating the dimensional tolerance of the tray.
13	N4 indicates the package type accommodated.
14	Bottom side-wall notches require a minimum depth of 2 mm to facilitate auto handling equipment.
15	All tray measurements are to be made with the tray unrestrained.
16	Sharp edges that could cause damage to dry-pack bags or other packaging material should be avoided regardless of whether or not an edge or corner radius is specified.
17	There should be space for a recycle logo and material code or material declaration close to Detail B.

5 Polarity and orientation of components in the tray

5.1 Pin one

Pin 1 of the component shall be orientated towards the tray chamfer corner or the side of the tray with the centre scallop.

5.2 Loading

Components shall be loaded into the tray starting at the lower right corner diagonally opposite the chamfered corner of the tray. Proceeding from bottom to top and right to left, the columns shall be completely filled from bottom to top before placing a component in the next column.

6 Tray stacking

6.1 Bundling

Trays may be bundled in stacks providing the stacks contain only components of the same part number and the same manufacturer.

6.2 Top protection

The top tray containing components shall be protected by an empty tray or a suitable equivalent lid.

6.3 Partial filling

A stack of trays shall not contain more than one partially filled tray. Except for the protective cover tray (lid), any partially filled tray shall be the top tray of the stack as received from the supplier.

6.4 Protrusion of components

The component shall not protrude above the top surface profile of the tray. A heat-sink, attached to the top of a component, may protrude above the top surface of the tray. When such a heat-sink is used, suitable "spacer" trays shall be used in the stack.

6.5 Stack-up

Trays shall be stackable without interference and shall not stick together during unstacking operations.

6.6 Damaging of components

Trays shall be stackable without damaging contained components.

7 Missing components

Missing components are not allowed, except for an intentionally partially filled tray as described in 6.3.

8 Marking

The tray shall be marked with the following.

- a) The type of component the tray is intended to obtain.
- b) The temperature in degrees Celsius, which the empty tray will withstand for 48 continuous hours, without violating the dimensional tolerance of the tray.
- c) When required, a label with information in normal script or in code form, for example, OCR bar code, magnetic, etc., for automatic reading shall be placed on the right side of the tray (opposite side from scallop).
 - In the case of bar codes, it is recommended to use bar code 39.
 - For optical character recognition, OCR B should be used.

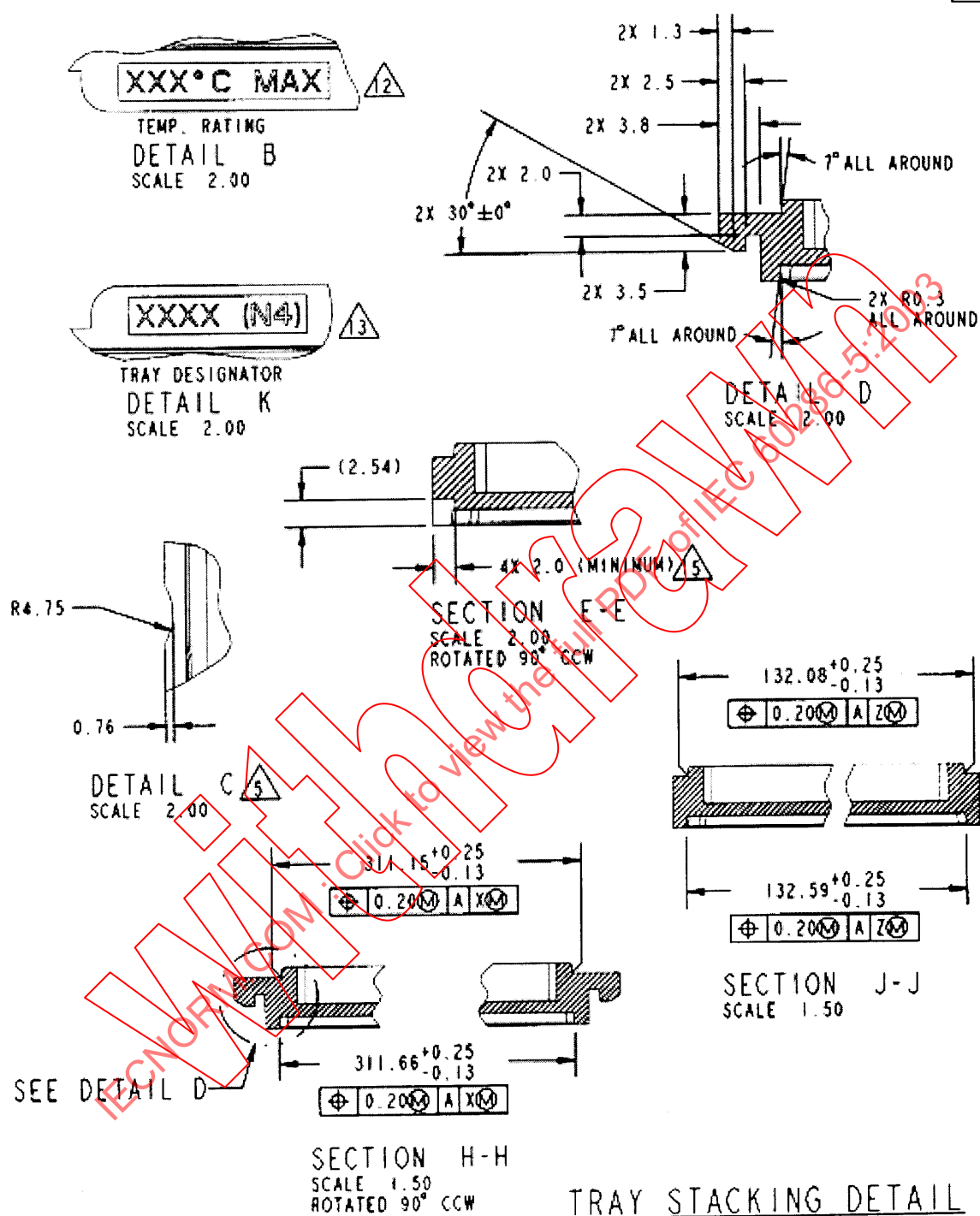


Figure A.1b – Stacking details

NOTE For notes, see page 26.

Figure A.1 – Thin tray

A.1.2 Variation sheets

The following are the abbreviations used in Tables A.1 and A.2.

BGA	(<u>B</u> all <u>G</u> rid <u>A</u> rray)
CQFP	(<u>C</u> eramic <u>Q</u> uad <u>F</u> lat <u>P</u> ack)
MQFP	(<u>M</u> etric <u>Q</u> uad <u>F</u> lat <u>P</u> ack)
PLCC	(<u>P</u> lastic <u>L</u> eaded <u>C</u> hip <u>C</u> arrier)
PQFP	(<u>P</u> lastic <u>Q</u> uad <u>F</u> lat <u>P</u> ack)
TQFP	(<u>T</u> hin <u>Q</u> uad <u>F</u> lat <u>P</u> ack)
SOJ	(<u>S</u> mall <u>O</u> utline <u>J</u> -Leaded Package)
TSOP (I)	(type 1 <u>T</u> hin <u>S</u> mall <u>O</u> utline <u>P</u> ackage)
TSOP (II)	(type 2 <u>T</u> hin <u>S</u> mall <u>O</u> utline <u>P</u> ackage)

Withdrawing
IECNORM.COM: Click to view the full PDF of IEC 60286-5:2003

Table A.1 – Variations

Tray		M	M1	M2	M3	N	N1	N2	N3	N4	N5	N6	Origin	
Type	Component Type	Basic Dim.	Basic Dim.	Basic Dim.	Basic Dim.	Pin count	Columns	Rows	Pockets	Form	Row/Column	Row/Column	Standard	Var
A1.B1	BGA	26,70	20,00	27,50	27,50	256; 361; 576	4	11	44	25 x 25	2/2; 10/3	6/2-3	CO-028: B	AA
A1.B2	BGA	24,15	26,10	29,20	29,20	324; 441; 676	4	10	40	27 x 27	2/2; 9/3	5/3; 6/2	CO-028: B	AB
A1.B3	BGA	20,85	31,10	31,60	31,40	361; 484; 784	4	9	36	29 x 29	2/2; 8/3	5/2-3	CO-028: B	AC
A1.B4	BGA	25,05	21,90	33,90	42,90	400; 576; 900	3	9	27	31 x 31	2/2; 8/2	5/2	CO-028: B	AD
A1.B5	BGA	32,45	33,25	35,50	35,50	441; 484; 625; 676; 1024	3	8	24	32,5 x 32,5; 33 x 33	2/2; 7/2	4/2; 5/2	CO-028: B	AE
A1.B6	BGA	29,95	24,50	38,00	38,00	529; 729; 1156	3	8	24	35 x 35	2/2; 7/2	4/2; 5/2	CO-028: B	AF
A1.B7	BGA	27,95	37,50	40,00	40,00	625; 841; 1369	3	7	21	37,5 x 37,5	2/2; 6/2	4/2	CO-028: B	AG
A1.B8	BGA	25,65	30,60	42,30	42,30	676; 961; 1521	3	7	21	40 x 40	2/2; 6/2	4/2	CO-028: B	AH
A1.B9	BGA	26,70	43,75	45,50	82,50	784; 1089; 1764	2	6	12	42,5 x 42,5	not applicable	not applicable	CO-028: B	AJ
A1.B10	BGA	30,00	30,00	51,00	75,90	900; 1225; 1936	2	6	12	45 x 45	1/1; 6/2	3/2; 4/1	CO-028: B	AK
A1.B11	BGA	30,00	31,25	50,50	75,90	961; 1369; 2209	2	6	12	47,5 x 47,5	1/1; 6/2	3/2; 4/1	CO-028: B	AL
A1.B12	BGA	41,45	51,50	53,00	53,00	1089; 1521; 2401	2	5	10	50 x 50	1/1; 5/2	3/1; 3/2	CO-028: B	AM
A1.B13	BGA	20,95	20,00	27,50	23,50	224; 304; 480	5	11	55	25 x 21	2/2; 10/4	6/2-4	CO-028: B	BA
A1.B14	BGA	26,70	33,25	35,50	27,50	336; 475; 744	4	8	32	32,5 x 25	2/2; 7/3	4/2-3; 5/2-3	CO-028: B	BB
A1.B15	BGA	11,55	11,80	9,40	9,40	16; 25; 36	13	32	416	7 x 7	4/7; 29/7	15-18/6-7	CO-029: A	AA
A1.B16	BGA	16,65	15,00	11,40	11,40	36; 49; 64	10	26	260	9 x 9	3/5; 24/6	12-15/4-7	CO-029: A	AB
A1.B17	BGA	17,20	16,80	13,40	14,50	49; 64; 100	8	22	176	11 x 11	3/4; 20/5	11-12/4-5	CO-029: A	AC
A1.B18	BGA	15,45	15,00	15,00	15,00	64; 100; 144	8	20	160	13 x 13	3/4; 18/5	10-11/4-5	CO-029: A	AD
A1.B19	BGA	16,35	11,30	17,20	17,20	100; 121; 196	7	18	126	15 x 15	2/4; 17/4	9-10/3-5	CO-029: A	AE
A1.B20	BGA	19,20	21,00	19,50	19,50	121; 169; 256	6	15	90	17 x 17	2/3; 14/4	7-9/3-4	CO-029: A	AF
A1.B21	BGA	14,60	18,79	21,34	21,34	144; 196; 225; 289; 324	6	14	84	19 x 19; 18,5 x 18,5	2/3; 13/4	7-8/3-4	CO-029: A	AG
A1.B22	BGA	20,15	26,05	23,90	23,90	196; 256; 400	5	12	60	21 x 21	2/2; 11/4	6-7/2-4	CO-029: A	AH
A1.B23	BGA	16,95	17,25	25,50	25,50	225; 324; 484	5	12	60	23 x 23	2/2; 11/4	6-7/3	CO-029: A	AJ
A1.B24	BGA	26,70	20,00	27,50	27,50	256; 361; 576	4	11	44	25 x 25	2/2; 10/3	6/2-3	CO-029: A	AK
A1.B25	BGA	25,40	29,70	28,40	28,40	—	4	10	40	26 x 26	2/2; 9/3	5-6/2-3	ED-7613	—

A1.B26	BGA	2	24,15	26,10	29,20	29,20	324; 441; 676	4	10	40	27 x 27	2/2; 9/3	5/3; 6/2	CO-029: A	AL
A1.B27	BGA	2	20,85	31,10	31,60	31,40	361; 484; 784	4	9	36	29 x 29	2/2; 8/3	5/2-3	CO-029: A	AM
A1.B28	BGA	2	25,05	21,90	33,90	42,90	400; 576; 900	3	9	27	31 x 31	2/2; 8/2	5/2	CO-029: A	AN
A1.B29	BGA	2	32,45	33,25	35,50	36,50	441; 484; 625; 676; 1024	3	8	24	33 x 33; 32,5 x 32,5	2/2; 7/2	4-5/2	CO-029: A	AP
A1.B30	BGA	2	29,95	24,50	38,00	38,00	529; 729; 1156	3	8	24	35 x 35	2/2; 7/2	4-5/2	CO-029: A	AR
A1.B31	BGA	2	27,95	37,50	40,00	40,00	625; 841; 1369	3	7	21	37,5 x 37,5	2/2; 6/2	4/2	CO-029: A	AS
A1.B32	BGA	2	26,65	30,60	42,30	42,30	676; 961; 1521	3	7	21	40 x 40	2/2; 6/2	4/2	CO-029: A	AT
A1.B33	BGA	2	26,70	43,75	45,50	82,50	784; 1089; 1764	2	6	12	42,5 x 42,5	not applicable	not applicable	CO-029: A	AU
A1.B34	BGA	2	30,00	30,00	51,00	75,90	900; 1225; 1836	2	6	12	45 x 45	1/1; 6/2	3/2; 4/1	CO-029: A	AV
A1.B35	BGA	2	30,00	31,25	50,50	75,90	961; 1369; 2209	2	6	12	47,5 x 47,5	1/1; 6/2	3/2; 4/1	CO-029: A	AW
A1.B36	BGA	2	41,45	51,50	53,00	53,00	1089; 1521; 2401	2	5	10	50 x 50	1/1; 5/2	3/1-2	CO-029: A	AX
A1.B37	BGA	2	9,00	9,15	12,90	13,10	25; 36; 49; 64; 81	10	24	240	10 x 10	2/5; 23/6	11-14/4-6	CO-029: D	AY
A1.B38	BGA	2	9,55	10,00	14,75	14,60	49; 64; 81; 100; 121	9	21	189	12 x 12	2/5; 20/5	10-12/4-6	CO-029: D	AZ
A1.B39	BGA	2	12,75	23,30	24,40	18,40	119; 153	7	12	84	22 x 14	2/4; 11/4	6-7/3-5	CO-029: A	BA
A1.B40	BGA	2	14,60	16,50	23,50	21,34	168; 224; 340	6	13	78	21 x 18,5	2/3; 12/4	7/3-4	CO-029: A	BB
A1.B41	BGA	2	20,95	20,00	27,50	23,50	224; 304; 480	5	11	55	25 x 21	2/2; 10/4	6/2-4	CO-029: A	BC
A1.B42	BGA	2	26,70	33,25	35,50	27,50	336; 475; 744	4	8	32	32,5 x 25	2/2; 7/3	4-5/2-3	CO-029: A	BD
A1.B43	BGA	2	11,60	24,95	24,10	16,10	119; 153	8	12	96	22 x 14	2/4; 11/5	6-7/4-5	CO-029: B	BE
A1.B44	BGA	2	8,20	12,60	20,70	11,95	60	11	15	165	16 x 8	6/2; 6/14	5-7/7-9	CO-029: D	BF
A1.C1	CQFP	1	17,81	17,93	25,37	25,07	28; 52	5	12	60		3/3; 10/3	6-7/3	CO-011: B	AA
A1.C2	CQFP	1	20,93	23,98	33,38	31,34	68	4	9	36		2/2; 8/3	5/2	CO-011: B	AB
A1.C3	CQFP	1	29,49	29,49	38,05	38,46	44; 84	3	8	24		2/2; 7/2	5/2	CO-011: B	AC
A1.C4	CQFP	1	20,93	23,98	33,38	31,34	52; 100	4	9	36		2/2; 8/3	5/2	CO-011: B	AD
A1.C5	CQFP	1	20,93	23,98	33,38	31,34	68; 132	4	9	36		2/2; 8/3	5/2	CO-011: B	AE
A1.C6	CQFP	1	29,49	29,49	38,05	38,46	84; 164	3	8	24		2/2; 7/2	5/2	CO-011: B	AF
A1.D1	MQFP	1	18,30	17,25	18,70	19,86	36; 44; 52; 64; 80	6	16	96	10 x 10	3/3; 14/4	8-9/3-4	CS-004: A	AA
A1.D2	MQFP	1	15,45	17,75	21,50	21,00	52; 64; 80; 100; 120	6	14	84	14 x 14	3/3; 12/4	7-8/3-4	CS-004: A	AB
A1.D3	MQFP	1	15,45	22,50	27,00	21,00	64; 80; 100; 128	6	11	66	14 x 20	2/3; 10/4	6/3-4	CS-004: A	AC
A1.D4	MQFP	1	30,93	27,93	37,02	37,02	120; 128; 144; 160; 208; 256	3	8	24	28 x 28	2/2; 7/2	4-5/2	CS-004: A	AD
A1.D5	MQFP	1	26,57	25,13	37,82	41,38	184; 240; 296	3	8	24	32 x 32	2/2; 7/2	4-5/2	CS-004: A	AE
A1.D6	MQFP	1	29,22	31,10	50,56	77,46	232; 304; 376	2	6	12	40 x 40	not applicable	not applicable	CS-004: A	AF

A1.D7	MQFP	1	10,20	11,05	10,10	10,50	32; 40	12	30	360	5 x 5	2/6; 29/7	14-17/5-8	CS-004: B	AG
A1.D8	MQFP	1	11,25	11,10	12,20	12,60	32; 40; 48; 64	10	25	250	7 x 7	2/5; 24/6	12-14/4-7	CS-004: B	AH
A1.D9	MQFP	1	13,95	14,30	17,90	18,00	48; 64; 80; 100	7	17	119	12 x 12	2/4; 16/4	8-10/3-5	CS-004: B	AJ
A1.D10	MQFP	1	17,55	17,80	25,40	25,20	128; 144; 176	5	12	60	20 x 20	2/3; 11/3	6-7/2-4	CS-004: B	AK
A1.D11	MQFP	1	20,70	20,70	30,40	31,50	160; 176; 216	4	10	40	24 x 24	2/2; 9/3	5-6/2-3	CS-004: B	AL
A1.D12	MQFP	1	26,40	32,70	41,60	41,60	—	3	7	21	36 x 36	2/2; 6/2	4/2	ED-7614	—
A1.E1	MQFP-HD	1	13,00	13,10	15,20	15,70	44; 52; 64; 80	8	20	160	10 x 10	2/4; 19/5	10-11/4-5	CO-027: B	AC
A1.E2	MQFP-HD	1	15,45	15,40	20,30	21,00	52; 64; 80; 100; 120	6	15	90	14 x 14	2/3; 14/4	7-9/3-4	CO-027: B	AE
A1.E3	MQFP-HD	1	15,45	17,80	25,40	21,00	80; 100; 128	6	12	72	14 x 20	2/3; 11/4	6-7/3-4	CO-027: B	AF
A1.F1	PLCC	1	11,80	17,09	14,78	11,23	18	11	20	220	rectangular	3/6; 18/6	10-11/5-7	CS-003: A	AA
A1.F2	PLCC	1	10,80	17,25	16,50	11,43	22	11	18	198	rectangular	3/6; 16/6	9-10/5-7	CS-003: A	AB
A1.F3	PLCC	1	16,11	22,20	18,04	12,96	28	9	16	144	rectangular	2/5; 15/5	8-9/4-6	CS-003: A	AC
A1.F4	PLCC	1	13,70	22,20	18,04	15,50	32	8	16	128	rectangular	2/4; 15/5	8-9/4-5	CS-003: A	AD
A1.F5	PLCC	1	16,11	14,94	12,96	12,96	20	9	23	207	square	4/5; 20/5	11-13/4-6	CS-003: A	AE
A1.F6	PLCC	1	13,70	18,00	15,50	15,50	28	8	19	152	square	3/4; 17/5	9-11/4-5	CS-003: A	AF
A1.F7	PLCC	1	16,50	23,73	20,58	20,58	44	6	14	84	square	2/3; 13/4	7-8/3-4	CS-003: A	AG
A1.F8	PLCC	1	21,71	18,78	23,12	23,12	52	5	13	65	square	2/3; 12/3	6-8/2-4	CS-003: A	AH
A1.F9	PLCC	1	25,65	30,60	28,20	28,20	68	4	10	40	square	2/2; 9/3	5-6/2-3	CS-003: A	AJ
A1.F10	PLCC	1	34,67	24,38	33,28	33,28	84	3	9	27	square	2/2; 8/2	5/2	CS-003: A	AK
A1.F11	PLCC	1	29,59	23,24	38,36	38,36	100	3	8	24	square	2/2; 7/2	4-5/2	CS-003: A	AL
A1.G1	PQFP	1	15,70	18,24	23,21	20,90	68	6	13	78	—	3/3; 11/4	6-8/3-4	CS-002: A	AA
A1.G2	PQFP	1	17,81	17,91	25,38	25,07	84	5	12	60	—	3/3; 10/3	6-7/2-4	CS-002: A	AB
A1.G3	PQFP	1	17,81	19,05	27,69	25,07	100	5	11	55	—	3/3; 9/3	6/2-4	CS-002: A	AC
A1.G4	PQFP	1	20,94	23,98	33,38	31,34	132	4	9	36	—	2/2; 8/3	5/2-3	CS-002: A	AD
A1.G5	PQFP	1	29,49	24,29	38,06	38,46	164	3	8	24	—	2/2; 7/2	4-5/2	CS-002: A	AE
A1.G6	PQFP	1	26,17	27,03	43,49	41,78	196	3	7	21	—	2/2; 6/2	4/2	CS-002: A	AF
A1.G7	PQFP	1	42,37	30,60	50,76	51,16	244	2	6	12	—	2/4; 5/2	3-4/1-2	CS-002: A	AG
A1.H1	SOJ	1	10,20	14,30	17,90	10,50	24	12	17	204	7,62 x 15,87	2/6; 16/7	8-10/5-8	CO-032: A	AA
A1.H2	SOJ	1	10,20	13,50	19,20	10,50	20; 24	12	16	192	7,62 x 17,14	2/6; 15/7	8-9/5-8	CO-032: A	AB
A1.H3	SOJ	1	10,20	14,70	20,40	10,50	28	12	15	180	7,62 x 18,14	2/6; 14/7	7-9/5-8	CO-032: A	AC
A1.H4	SOJ	1	10,20	19,80	22,95	10,50	32	12	13	156	7,62 x 20,95	2/6; 12/7	6-8/5-8	CO-032: A	AD
A1.H5	SOJ	1	10,20	25,65	29,30	10,50	42	12	10	120	7,62 x 27,30	2/6; 9/7	5-6/5-8	CO-032: A	AE

A1.H6	SOJ	1	15,15	14,70	20,40	13,20	24; 24	9	15	135	10,16 x 18,14	2/5; 14/5	7-9/4-5	CO-032: A	BA
A1.H7	SOJ	1	15,15	19,80	22,95	13,20	32	9	13	117	10,16 x 20,95	2/5; 12/5	6-8/4-6	CO-032: A	BB
A1.H8	SOJ	1	15,15	23,85	24,30	13,20	34	9	12	108	10,16 x 22,22	2/5; 11/5	6-7/4-5	CO-032: A	BC
A1.H9	SOJ	1	15,15	17,25	25,50	13,20	36	9	12	108	10,16 x 23,49	2/5; 11/5	6-7/4-6	CO-032: A	BD
A1.H10	SOJ	1	15,15	17,50	28,00	13,20	40	9	11	99	10,16 x 26,03	2/5; 10/5	6/4-6	CO-032: A	BE
A1.H11	SOJ	1	14,75	24,75	29,50	13,30	42	9	10	90	10,16 x 27,30	2/5; 9/5	5-6/4-6	CO-032: A	BF
A1.H12	SOJ	1	15,15	19,80	30,60	13,20	44	9	10	90	10,16 x 28,57	2/5; 9/5	5-6/4-6	CO-032: A	BG
A1.K1	TQFP	1	10,20	11,05	10,10	10,50	32; 40	12	30	360	5 x 5	2/6; 27/7	14-17/5-8	CS-007: A	AA
A1.K2	TQFP	1	11,25	11,10	12,20	12,60	32; 40; 48; 64	10	25	250	7 x 7	2/5; 24/6	12-14/4-7	CS-007: A	AB
A1.K3	TQFP	1	13,00	13,10	15,20	15,70	36; 44; 52; 64; 80	8	20	160	10 x 10	2/4; 19/5	10-11/4-5	CS-007: A	AC
A1.K4	TQFP	1	13,95	14,30	17,90	18,00	44; 52; 64; 80; 100	7	17	119	12 x 12	2/4; 16/4	8-10/3-5	CS-007: A	AD
A1.K5	TQFP	1	15,45	15,40	20,30	21,00	52; 64; 80; 100; 120	6	15	90	14 x 14	2/3; 14/4	7-9/3-4	CS-007: A	AE
A1.K6	TQFP	1	15,45	17,80	25,40	21,00	100; 128	6	12	72	14 x 20	2/3; 11/4	6-7/3-4	CS-007: A	AF
A1.K7	TQFP	1	17,55	17,80	25,40	25,20	144; 176	5	12	60	20 x 20	2/3; 11/3	6-7/2-4	CS-007: A	AG
A1.K8	TQFP	1	20,70	20,70	30,40	31,50	176; 216	4	10	40	24 x 24	2/2; 9/3	5-6/2-3	CS-007: A	AH
A1.K9	TQFP	1	19,65	28,70	32,20	32,20	160; 208; 256	4	9	36	28 x 28	2/2-3; 8/2-3	5/2-3	CS-007: A	AJ
A1.L1	TSOP(I)	1	8,70	15,00	19,00	7,90	24	16	16	256	8 x 14	3/3-4; 14/13-14	8-9/7-10	CS-008: A	AA
A1.L2	TSOP(I)	1	8,70	14,00	20,50	7,90	24	16	15	240	6 x 16	3/3-4; 13/3-4	7/7-10; 9/7-10	CS-008: A	AB
A1.L3	TSOP(I)	1	8,70	16,50	23,50	7,90	24	16	13	208	6 x 18	2/3-4; 12/3-4	6-8/7-10	CS-008: A	AC
A1.L4	TSOP(I)	1	8,70	17,25	25,50	7,90	24	16	12	192	6 x 20	2/3-4; 11/3-4	6/7-10; 7/7-10	CS-008: A	AD
A1.L5	TSOP(I)	1	8,85	15,00	19,00	9,85	32	13	16	208	8 x 14	3/3-4; 14/10-11	8-9/6-8	CS-008: A	BA
A1.L6	TSOP(I)	1	8,85	14,00	20,50	9,85	32	13	15	195	8 x 16	2/3-4; 14/10-11	7-9/6-8	CS-008: A	BB
A1.L7	TSOP(I)	1	8,85	16,50	23,50	9,85	32	13	13	169	8 x 18	2/3-4; 12/10-11	6-8/6-8	CS-008: A	BC
A1.L8	TSOP(I)	1	8,85	14,50	26,00	9,85	32	13	12	156	8 x 20	2/3-4; 11/10-11	6-7/6-8	CS-008: A	BD
A1.L9	TSOP(I)	1	14,40	15,00	19,00	11,90	40	10	16	160	10 x 14	3/2-3; 14/8-9	8-9/4-7	CS-008: A	CA
A1.L10	TSOP(I)	1	14,40	14,00	20,50	11,90	40	10	15	150	10 x 16	2/2-3; 14/8-9	7-9/4-7	CS-008: A	CB
A1.L11	TSOP(I)	1	14,40	16,5	23,50	11,90	40	10	13	130	10 x 18	2/2-3; 12/8-9	6-8/4-7	CS-008: A	CC
A1.L12	TSOP(I)	1	14,40	17,25	25,50	11,90	40	10	12	120	10 x 20	2/2-3; 11/8-9	6-7/4-7	CS-008: A	CD
A1.L13	TSOP(I)	1	15,80	15,00	19,00	14,90	48	8	16	128	12 x 14	3/2-3; 14/6-7	8-9/4-5	CS-008: A	DA
A1.L14	TSOP(I)	1	15,80	14,00	20,50	14,90	48	8	15	120	12 x 16	2/2-3; 14/6-7	7-9/4-5	CS-008: A	DB
A1.L15	TSOP(I)	1	15,80	16,50	23,50	14,90	48	8	13	104	12 x 18	2/2-3; 12/6-7	6-8/4-5	CS-008: A	DC
A1.L16	TSOP(I)	1	15,80	17,25	25,50	14,90	48	8	12	96	12 x 20	2/2-3; 11/6-7	6-7/4-5	CS-008: A	DD

A1.L17	TSOP(I)	1	18,15	15,75	18,90	16,60	—	7	16	112	14 x 16	2/2-3; 15/5-6	8-9/3-5	CS-008: A	EA
A1.L18	TSOP(I)	1	18,15	21,65	20,90	16,60	—	7	14	98	14 x 18	2/2-3; 13/5-6	7-8/3-5	CS-008: A	EB
A1.L19	TSOP(I)	1	18,15	20,10	22,90	16,60	—	7	13	91	14 x 20	2/2-3; 12/5-6	6-8/3-5	CS-008: A	EC
A1.M1	TSOP(II)	1	12,30	13,95	19,14	11,13	20; 24; 26	11	16	176	7,62 x 17,14	3/3-4; 14/8-9	8-9/5-7	CS-005: A	AA
A1.M2	TSOP(II)	1	13,27	14,56	20,42	13,67	28; 40; 44/40	9	15	135	10,16 x 18,41	3/3-4; 13/6-7	7-9/4-6	CS-005: A	AB
A1.M3	TSOP(II)	1	13,27	19,74	22,96	13,67	32; 50/44; 50; 80	9	13	117	10,16 x 20,95	2/3-4; 12/6-7	6-8/4-6	CS-005: A	AC
A1.M4	TSOP(II)	1	19,32	24,18	24,24	16,21	34; 36; 54	7	12	84	12,70 x 22,25	2/2-3; 11/5-6	6-7/3-5	CS-005: A	AD
A1.M5	TSOP(II)	1	12,30	14,56	20,42	11,13	28; 44	11	15	165	7,62 x 18,41	3/3-4; 13/8-9	7-9/5-7	CS-005: B	AE
A1.M6	TSOP(II)	1	13,27	15,60	25,80	13,67	36; 64; 70; 86	9	12	108	10,16 x 22,22 10,16 x 23,49	2/3-4; 11/6-7	6-7/4-6	CS-005: B	AF
A1.M7	TSOP(II)	1	13,27	16,50	28,20	13,67	40	9	11	99	10,16 x 26,03	2/3-4; 10/6-7	6/4-6	CS-005: B	AG
A1.M8	TSOP(II)	1	13,27	18,00	31,00	13,67	70	9	10	90	10,16 x 28,57	2/3-4; 9/6-7	5-6/4-6	CS-005: B	AH
A1.M9	TSOP(II)	1	19,32	14,40	23,85	16,21	32; 50; 62	7	13	91	12,70 x 21,00	2/2-3; 12/5-6	6-8/3-5	CS-005: B	AJ
A1.M10	TSOP(II)	1	19,32	15,60	25,80	16,21	36	7	12	84	12,70 x 23,49	2/2-3; 11/5-6	6-7/3-5	CS-005: B	AK
A1.M11	TSOP(II)	1	19,32	16,50	28,20	16,21	40	7	11	77	12,70 x 26,03	2/2-3; 10/5-6	6/3-5	CS-005: B	AL
A1.M12	TSOP(II)	1	19,32	18,00	31,00	16,21	70	7	10	70	12,70 x 28,57	2/2-3; 9/5-6	5-6/3-5	CS-005: B	AM
A1.M13	TSOP(II)	1	12,00	21,70	24,70	14,00	—	9	12	108	10,16 x 22,22	2/3-4, 11/6-7	6-7/4-6	ED-7611	—

NOTE 1 Dimension M , $M1$, $M2$ and $M3$ define the centre lines for the cell sites. Package interface is controlled by package design and lead form.

NOTE 2 Symbol N refers to package lead-count supported, where applicable.

NOTE 3 Total usable cells $N3 = N1 \times N2$ (columns x rows). Columns run top to bottom along the length of the trays. Rows run left to right across the width of the trays.

NOTE 4 $N4$ indicates package type accommodated.

NOTE 5 The tray vacuum pick-up method allows two separate pick-up areas resulting in four closed cells per tray. Optical vacuum pick-up cell locations are $N5$.

NOTE 6 The tray vacuum pick-up method requires a minimum walled pick up area of 28 mm x 28 mm, located as close to the centre of the tray as is practical. Centre vacuum pick-up cell locations are $N6$.