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Packaging of components for automatic handling – Part 5: Matrix trays

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FOREWORD

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

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.

This consolidated version of IEC 60286-5 consists of the second edition (2003) [documents 40/1341/FDIS and 40/1364/RVD] and its amendment 1 (2009) [documents 40/1942/FDIS and 40/1971/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

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

The committee has decided that the contents of the base publication and its amendments 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- withdrawn,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.

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 with surface resistance equal to or greater than $1{,}0 \times 10^5$ ohms/square but less than $1{,}0 \times 10^{11}$ ohms/square.

2.2 Effect of properties

The tray material shall not adversely affect the mechanical, electrical characteristics, solder-ability, 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 mm – $M$3($N$1 – 1))/2

$M$1 is (315,0 mm – $M$2($N$2 – 1))/2

$M$2 is [(315,0 mm – 2P mm) – W($N$2 – 1)]/$N$2 + W

$M$3 is [(135,9 mm – 2P mm) – W($N$1 – 1)]/$N$1 + W

$N$1 is (135,9 mm –2P mm)/ET (rounded down to a whole number)

$N$2 is (315,0 mm – 2P 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, $N$1 and $N$2 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 $M$2 and $M$3 to maximize the pitch between the pockets while minimizing the edge of the tray to the centre line of the first pocket M and $M$1.

The dimensions P and W are given in Table 1.

Table 1 – P and W dimension

Dimension	Thin tray		Thick tray
	Normal stacking tray mm	Low stacking tray mm	mm
P	3,2	5,0	5,0
W	2,0	2,5	2,0

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)

P is the edge of the tray to the edge of the pocket

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 Table 1 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 2.

Table 2 – Height dimensions

Dimension	Thin tray		Thick tray
	Normal stacking tray	Low stacking tray	
	mm	mm	mm
A	7,62	7,62	12,19
$A1$	6,35	5,62	10,16
$A2$	1,27 typically	2,00 typically	2,03 typically

Measurement methodology of the tray outline dimensions, height, stacking feature dimensions and warpage are described in Annex B.

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).

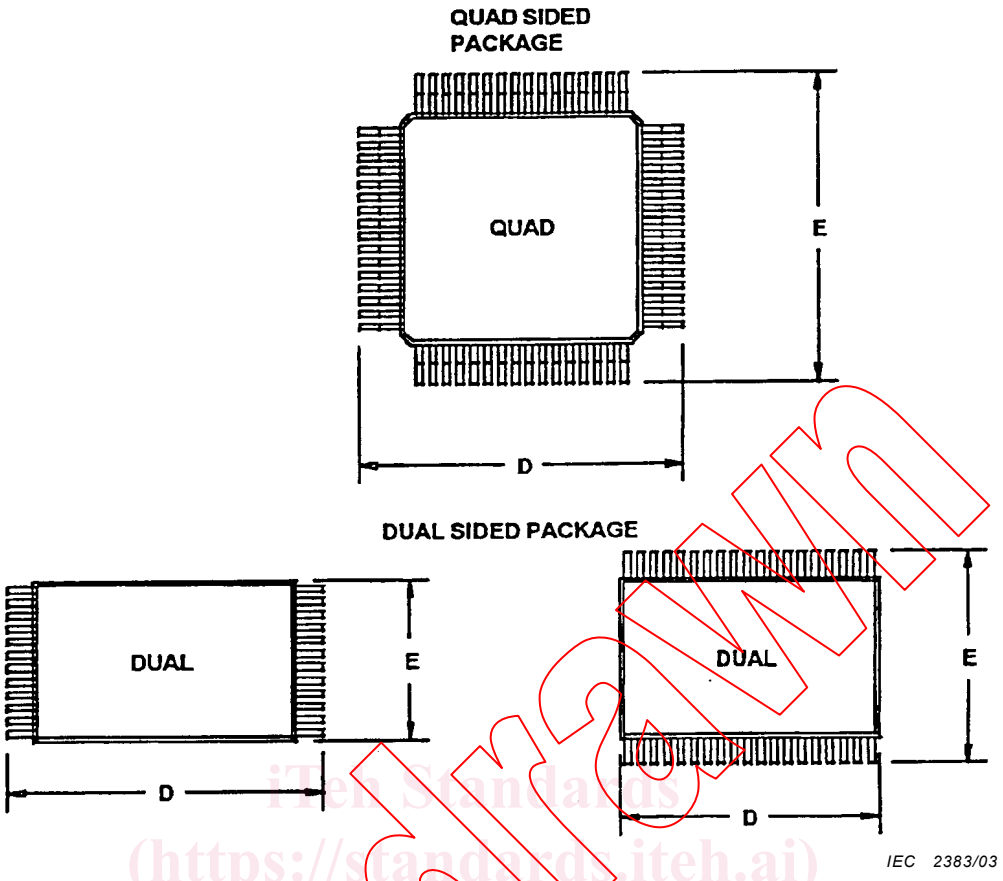

Figure 1 – Sample of leaded packages

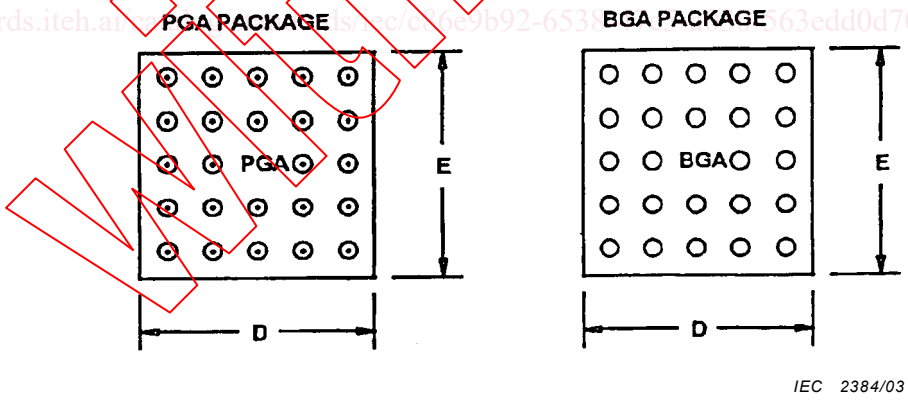

Figure 2 – Sample of grid array packages