

SEMI D25-0600^E (Reapproved 0706) SPECIFICATION FOR FLAT PANEL DISPLAY SUBSTRATE SHIPPING CASE

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^E This Standard was editorially modified in October 2003 to correct general editorial errors. Changes were made to §§ 3.2.2, 6.2.8.1, 6.2.9.1, and A3-1 (figure).

NOTICE: This Standard or Safety Guideline has an Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Purpose

1.1 This Document provides the packing and shipping specifications and/or guides for FPD glass substrates, which are called fourth generation substrates ($800 \times 950 \times 0.7$ mm or $800 \times 950 \times 1.1$ mm).

1.2 The objective of this Document is to provide cost-effective packing and shipping in terms of packing materials, storage, and shipping, while making sure that packing meets the quality and automation requirements.

2 Scope

2.1 This Document defines a specification for a full box type shipping case (see Figure 2) to be used for packing and shipping of 4th generation FPD glass substrates from the manufacturer of the glass substrate to the user.

2.2 The application of this packing specification is limited to the following four FPD glass substrates:

2.2.1 Bare glass substrates which can be used as array substrates, and do not have film deposition.

2.2.2 Bare glass substrates which can be used as facing substrates and color filter substrates, and do not have film deposition.

2.2.3 Array substrates which do have film deposition.

2.2.4 Facing substrates and color filter substrates which do have film deposition.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Prerequisites and Limitations

3.1 This Specification does not apply to:

3.1.1 Cassettes used for intra/inter bay transfer inside the user's plant;

3.1.2 The semi-separating type the contact type packing method (see Figure 4) or the full corner supporter type and the double side supporter type (see Figure 3).

3.2 The premise for glass substrates for this packing specification is as follows:

3.2.1 *Size*

- W (mm): Short Edge
- L (mm): Long Edge
- t (mm): Thickness
- W = 800 mm W tolerance: see SEMI D24
- L = 950 mm L tolerance: see SEMI D24
- t = 1.1 t tolerance = see SEMI D24

- $t = 0.7$ t tolerance = see SEMI D24

3.2.2 *Squareness* — see SEMI D24

3.2.3 *Beveling* — R beveling

3.2.4 *Orientation Corner* — see SEMI D24

3.2.5 *Corner Cut* — see SEMI D24

3.2.6 *Edge Exclusion Area* — see SEMI D24

3.2.7 *Sag* — In the event of the glass substrate being placed horizontally on the support as shown in Figure 1, sag is defined by h_2 (two sides supported), and h_4 (four sides supported) (unit = mm) (see Figure 1).

3.2.8 *Density* — Less than 2.8 g/cm^3

3.3 When the glass substrates are shipped, they shall be loaded vertically.

3.4 When the glass substrates are shipped, a standard sized pallet shall be used for efficient loading on the truck platform or the floor of the container (see Appendices 1 and 2). The standard size used here is less than $1,100 \times 1,100 \text{ mm}^2$ or, at the outside, $1,100 \times 1,200 \text{ mm}^2$.

3.5 When the glass substrates are shipped, the loading should be as efficient as possible utilizing the available space, in line with:

- The smallest height for truck platforms and containers is 2,300 mm (see Appendices 1 and 2).
- Taking into consideration the head clearance when loading and unloading by forklift, as well as the height of the shipping case, the maximum height of the load is approximately 2,000 mm. If more efficient loading can be achieved, multiple boxes can be stacked.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI D9 — Terminology for FPD Substrates

SEMI D11 — Specification for Flat Panel Display Glass Substrate Cassettes

SEMI D24 — Specification for Glass Substrates Used to Manufacture Flat Panel Displays

4.2 *ISO Standard*¹

ISO 668 — Series 1, Freight Container – Classification, Dimensions and Ratings

4.3 *JIS Documents*²

JIS D4002 — Internal Dimensions for Rear Body of Motor Trucks

JIS Z0604 — Wooden Flat Pallets

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 *Definitions*

5.1.1 *size of exposed portion* — the length of the glass substrate exposed from the packing box (full box type) when the lid of the packing box is open.

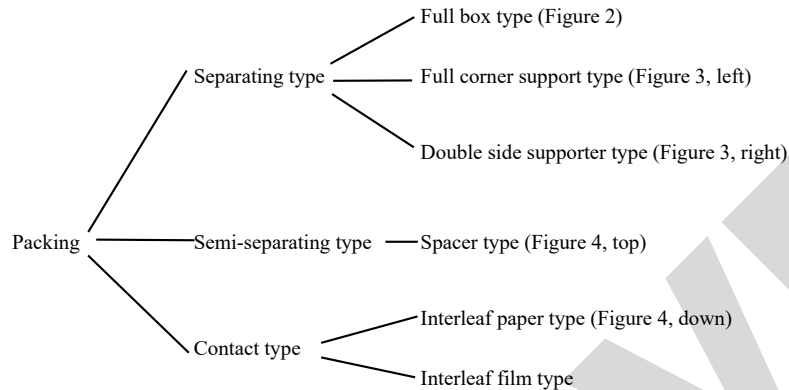
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² Japanese Standards Association, 4-1-24 Akasaka, Minato-ku, Tokyo 107-8440, Japan; Telephone: +81.3.3583.8005, Fax: +81.3.3586.2014, <http://www.jsa.or.jp>

6 Packing

6.1 Classification

6.1.1 Classification of packing is as follows:



6.2 *Packing Box Dimensions* — Figure 5 shows the key dimensions and tolerances of the packing box for the full box type.

6.2.1 *Packing Box Loading and Unloading*

6.2.1.1 Vertical loading shall be used to load and unload the glass substrates to and from the packing box (see Figure 6).

6.2.1.2 Vertical loading requires a tall loader/unloader because of the height of the loading direction. The ceiling height of the room where the loading equipment is installed has to be designed accordingly.

6.2.1.3 A suggested method for loading/unloading substrates from the shipping case with an automatic vertical loader/unloader is to tilt the box as shown in Figure 7. Align the substrates on one side of the clearance of the mizo and proceed with loading/unloading.

6.2.1.4 An alternative method for loading/unloading would be to rotate the packing box 90°, as shown in Figure 8.

6.2.1.5 Loading and unloading the substrates also can be done manually without using an automatic loader/unloader.

6.2.2 *Packing Box Size*

6.2.2.1 The shorter side of the substrate (side W, or the 800 mm side) as the vertical direction (direction z in Figure 5) during shipping. This way, the size of the substrate determines the inside measurements of the packing box, H: 800 mm (direction z), W: 950 mm (direction x).

6.2.2.2 The outside measurements of the packing box shall be H: 980 mm × W: 1,200 mm × L: ≤1100 mm (Figure 5). It is important to note that the height of 980 mm indicates that it is possible to stack up the packing boxes (i.e., 980 mm × 2 = 1,960 mm) and still be less than the possible maximum height (2,000 mm) of the truck load.

6.2.2.3 The length of the packing box is determined by the calculated product of the pitch size between the substrates times the number of substrates stored in the box. The length (L in Figure 5) of the packing box cannot exceed 1,100 mm.

6.2.3 *Packing Box Lid*

6.2.3.1 The packing box must prevent the substrates from getting contaminated as well as to give pressure to the substrates for securing them from both top and bottom. The lid must securely seal and be able to latch closed to the packing box by a lock. The latching mechanism must allow easy automatic lock and unlock as well.

6.2.3.2 The lid shall also have automatic and manual opening/closing capability. The inside of the lid is covered with a shock absorber that functions to secure the glass substrates by pressing them from the top and bottom.

6.2.4 Mizo Pitch and Capacity of Packing Boxes

6.2.4.1 The sag, $h_4 = 20$ mm will be for the substrates of the size $800 \times 950 \times 0.7$ mm as shown in Appendix 3, when a sudden turn, acceleration, or braking during shipping forces a 1G acceleration against the substrates. From this point of view, the pitch required here is a little bit larger than 20 mm. However, since all the substrates in the box are affected by the acceleration at the same time and in the same direction, the distance between the substrates will remain constant which means the substrates should not touch each other.

6.2.4.2 The mizo pitch, must be standardized by each shipping case supplier, but must range from a minimum of 9 mm to a maximum of 22 ± 0.2 mm. Table 1 shows possible number of substrates per shipping case at a given pitch.

Table 1 Pitch and Number of Substrates

<i>Pitch (mm)</i>	<i>Number of Substrates (pc)</i>
22	40
18	50
15	60
11	80
9	100

6.2.4.3 The first mizo clearance (see Figure 9) is to be more than 40 mm at the center of the groove. The distance from the reference plane to the first mizo is the sum of the first mizo clearance and the thickness of the side of the box which is the reference plane, and its allowance is ± 1.0 mm. The allowance of cumulative pitch distance is less than ± 2.0 mm, and that of each pitch is less than ± 1.0 mm.

6.2.4.4 Mizo clearance shall be designed to store the glass substrate of a thickness ranging from 0.7 mm to 1.1 mm.

6.2.5 Size of Exposed Portion

6.2.5.1 In this Document, the size of f_1 in Figure 10 is called “the size of the exposed portion” which is set as $f_1 = 100$ mm. Size h in Figure 10 is the shorter side of the substrate at 800 mm. The size of f_2 is 700 mm which means one eighth of the whole substrate is exposed.

6.2.6 Reference Plane

6.2.6.1 The reference plane needs to be determined as follows from three directions, x , y , and z in Figure 5 for automatic transferring:

- x : Both sides or center position
- y : Both sides or center position
- z : Bottom surface of the box (not the bottom of the skid described later)

6.2.6.2 Specifically use the small area as a reference surface in Figure 11. The detail of the position and size of the reference surfaces shall be standardized to use a compatible reference for two different design boxes. Also, the center line of substrate is automatically defined by symmetrical location between substrate and reference plane of case.

6.2.7 Transfer and Lift Method for Packing Boxes

6.2.7.1 It is expected that not only boxes containing glass substrates, but also empty boxes are fairly heavy. At least, they probably cannot be carried by hand. Therefore, it is assumed that whether the box contains glass substrates or not and whether the box is in a regular room or a clean room, it shall be lifted by a forklift and transferred mechanically. To accommodate a mechanical transfer and lift, skids must be installed at the bottom of the box so that the forklift can insert its tongues underneath the box (see Figure 5). The height of the skids shall be standardized for each shipping case supplier, but not exceed 150 mm.

6.2.7.2 Assuming lifting of the box and short distance, transfer is done using a balancer; the packing box is required to have handles, as shown in Figure 12, on the sides of the box. The structure of the handles shall be designed in such a way that it does not hinder the reference plane.

6.2.8 Packing Box Strength

6.2.8.1 The weight of the contents of the box, with the prescribed number of substrates, can be calculated from the density of substrates. The packing box has to be strong enough to bear that weight. Moreover, it has to be strong enough to hold another full box on top of itself.

6.2.8.2 Stacking three boxes with glass substrates is prohibited. Therefore, there is no need for the packing box strength to hold two boxes on top of one box. However, empty boxes may be stacked three high, but the box has to be designed to bear the weight of two empty boxes.

6.2.8.3 The handles shall be strong enough to hold the weight when the box is filled with glass substrates as well as a full box on top or two empty boxes on top.

6.2.9 Packing Box Material

6.2.9.1 Packing box material is not covered in this Document. Neither carcinogen nor de-gasification is covered. For the purpose of cleaning, cleanliness, and particle reduction, the material of the box has to be washable and solvent-resistant. The addition of draining holes is acceptable. Material must meet cleanliness, mechanical strength, and durability in line with specifications of this Document.

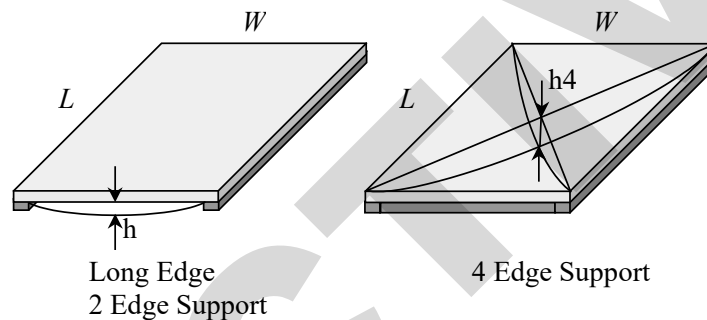


Figure 1
Sag

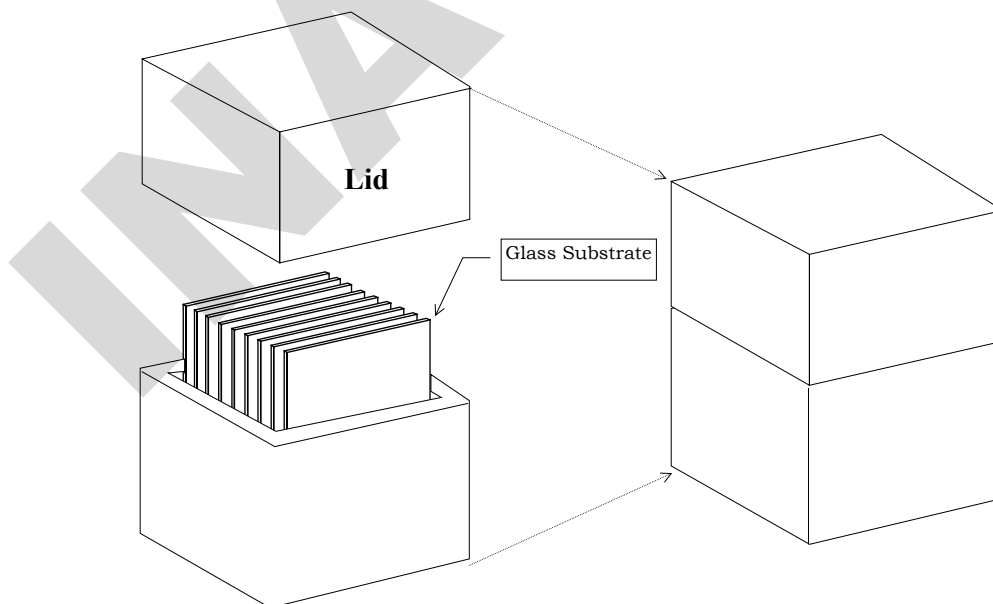
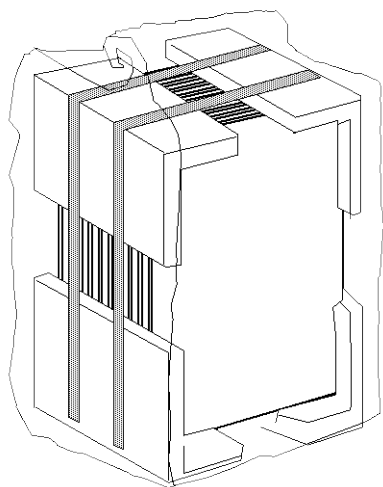
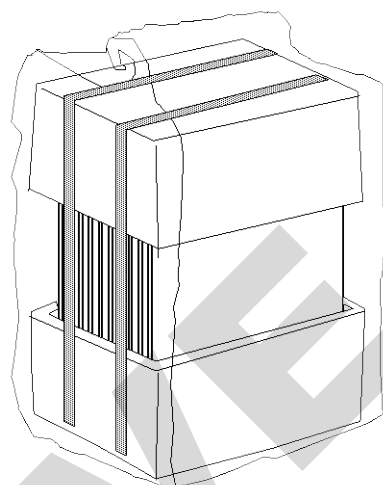


Figure 2
Full Box Type

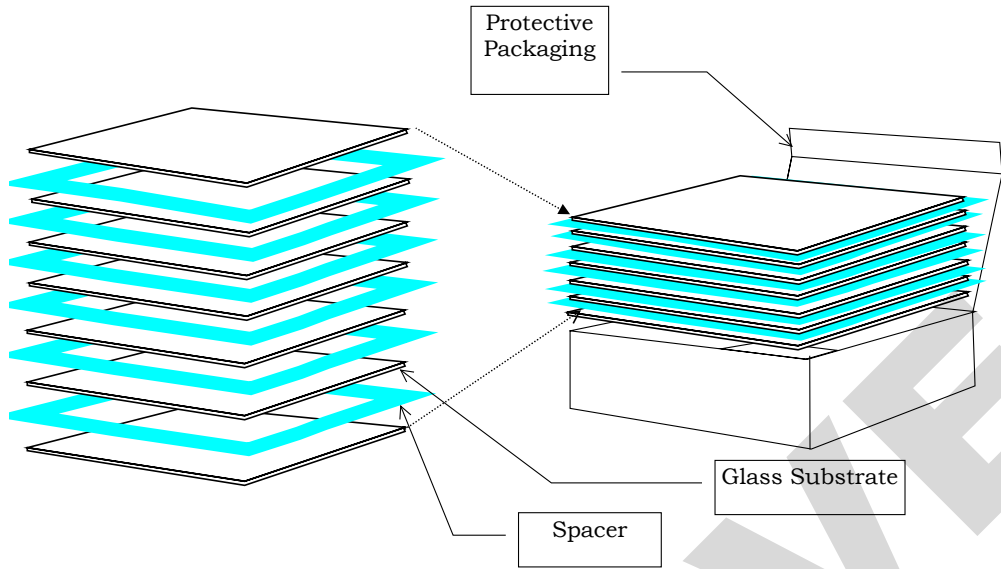


4 Corner Supporter Type

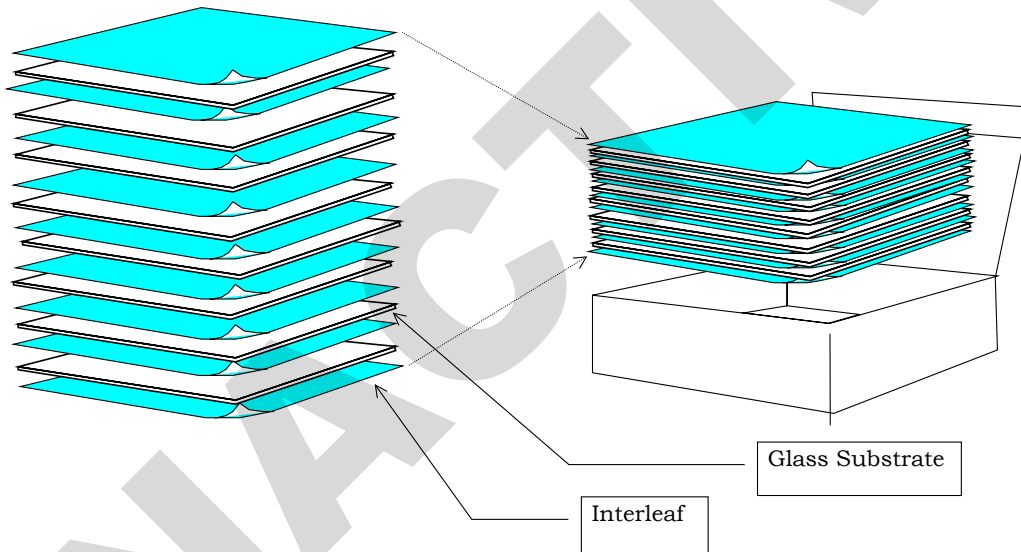


2 Edge Supporter Type

Figure 3
Partial Box Type



Spacer Type



Interleaf Type

Figure 4
Separator Contact Types

Unit: mm

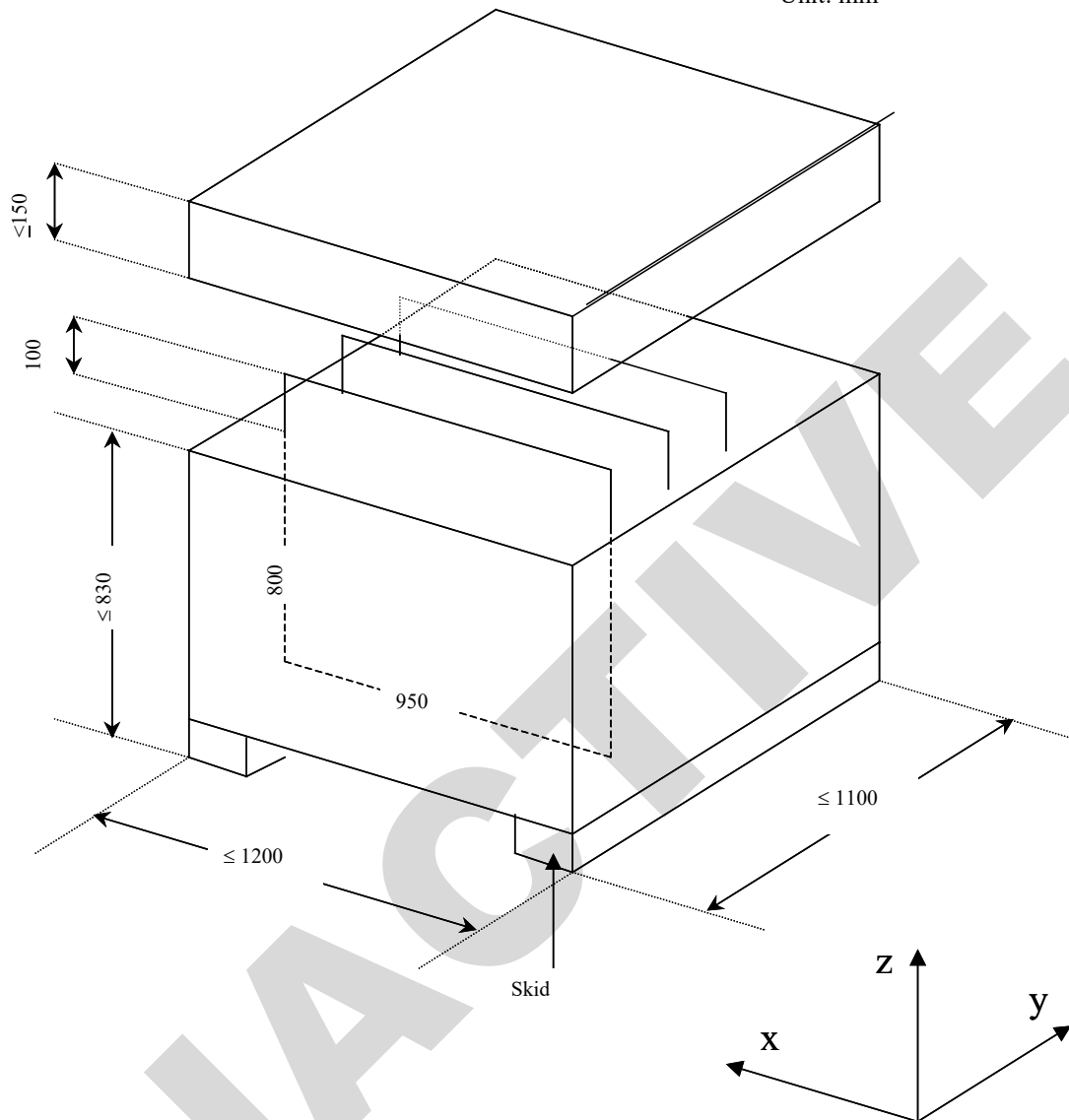


Figure 5
Packing Box Concept