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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Surface mounting technology –
Part 2: Transportation and storage conditions of surface mounting devices (SMD) – Application guide

Technique du montage en surface –
Partie 2: Conditions de transport et de stockage des composants pour montage en surface (CMS) – Guide d'application

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SURFACE MOUNTING TECHNOLOGY –

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FOREWORD

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International Standard IEC 61760-2 has been prepared by IEC technical committee 91: Electronics assembly technology.

This second edition cancels and replaces the first edition, published in 1998, and constitutes a technical revision.

The main changes with regard to the previous edition concern:

The standard was updated and editorially revised. Specific reference is made to:

IEC/TS 61340-5-1 [1] : Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

[1] A new edition of this publication exists: IEC 61340-5-1.

IEC/TR 61340-5-2: Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide

For convenience of the reader, an informative Annex A was added, which contains information about the climatic and mechanical conditions during transportation and storage (extracted from IEC 60721-3-1 and IEC 60721-3-2).

This bilingual version, published in 2008-05, corresponds to the English version.

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

CDV	Report on voting
91/569/CDV	91/634/RVC

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

The French version of this standard has not been voted upon.

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

A list of all the parts in the IEC 61760 series, under the general title *Surface mounting technology*, can be found on the IEC website.

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- withdrawn,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.

SURFACE MOUNTING TECHNOLOGY –

Part 2: Transportation and storage conditions of surface mounting devices (SMD) – Application guide

1 Scope and object

This International Standard describes the transportation and storage conditions for surface mounting devices (SMDs) that are fulfilled in order to enable trouble-free processing of surface mounting devices, both active and passive. (Conditions for printed boards are not taken into consideration.)

The object of this standard is to ensure that users of SMDs receive and store products that can be further processed (e.g. positioned, soldered) without prejudice to quality and reliability. Improper transportation and storage of SMDs may cause deterioration and result in assembly problems such as poor solderability, delamination and "popcorning".

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 60286-3, *Packaging of components for automatic handling – Part 3: Packaging of surface mount components on continuous tapes*

IEC 60286-4, *Packaging of components for automatic handling – Part 4: Stick magazines for electronic components encapsulated in packages of form* **E** and **G**

IEC 60286-5, *Packaging of components for automatic handling – Part 5: Matrix trays*

IEC 60286-6, *Packaging of components for automatic handling – Part 6: Bulk case packaging for surface mounting components*

IEC 60721-3-1, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60749 (all parts), *Semiconductor devices – Mechanical and climatic test methods*

IEC/TS 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

IEC/TR 61340-5-2, *Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide*

3 General conditions

Surface mounting devices shall be packed in such a way that products are protected during transportation and storage without loss of their properties arising from mechanical, environmental and electrical influences. Packing requirements as defined in various IEC publications, such as IEC 60286-3, IEC 60286-4, IEC 60286-5, IEC 60286-6, may contribute to the protection of components during transportation and storage.

Usually, transportation conditions are less controlled than storage conditions. Nevertheless, conditions shall be controlled and deviations from the advised conditions in this standard should be reduced to as little time as possible.

4 Transportation conditions

4.1 General transportation conditions

During transportation, the SMDs, including their chosen style of tapes or stick magazines, etc., shall be protected against extreme temperature, humidity and mechanical forces. Unless otherwise specified by the component supplier, the following environmental conditions shall be met:

Climatic condition according to IEC 60721-3-2, class 2K2, except

– low air temperature: –40 °C,
– change of temperature air/air: –40 °C / +30 °C,
– low air pressure: 30 kPa,
– change of air pressure: 6 kPa/min.

Mechanical condition according to IEC 60721-3-2, class 2M1. Transportation shall be managed in such a way that boxes are not deformed and forces are not directly passed on to the inner packaging.

Total transportation time shall be as short as possible, but preferably not exceed 10 days. (Total transportation time is time when products are not within controlled storage conditions.)

4.2 Specific transportation conditions

Depending on the sensitivity of the products to be transported, a choice shall be made between air transport where conditions during flight are well controlled, or less controlled conditions, e.g. during rail or road transportation.

4.2.1 Category 1 (advised for all products)

Air transport (conditions during flights with conditioned cargo room).

Climatic conditions according to IEC 60721-3-2, class 2K1.

It should be realised that waiting time and loading operations at the airport are under less controlled conditions. These shall at least fulfil the general transportation conditions stated in 4.1.

4.2.2 Category 2

Rail, road, and unconditioned air transportation.

Only allowed for products and packaging systems that are not sensitive to the general transportation conditions stated in 4.1.

Minimum air pressure: corresponding to an altitude of <12 km (about 19,3 kPa).

5 Storage conditions

Well controlled storage conditions are a major factor in problem prevention. Do not store where the soldering properties can be deteriorated by harmful gases. Conditions that may expose products to detrimental electrical field strengths should be avoided. Exposure of the products to direct solar radiation should be avoided.

The following conditions are advised:

Climatic conditions according to IEC 60721-3-1, class 1K2, except:

– low relative humidity 10 %;
– high relative humidity 75 %.

The storage time as given by the manufacturer specification shall not be exceeded. It is however recommended that the total storage time should not exceed two years (manufacturer and customer) but should be limited to one year after receipt of the products by the customer. In specific cases, the exact storage time- and the re-qualification rules, if the time is exceeded, are given in the component specification. As a minimum at least the solderability of the components has to be re-qualified.

If longer storage times are needed, the manufacturer should be consulted to conclude arrangements for suitable storage and packaging conditions.

During storage the original smallest packaging unit (SPU) shall not be opened, the SPU should preferably remain in the original packaging.

Even though products are stored for a shorter period of time, it is advised to apply the above-mentioned temperature and humidity conditions.

For “last call” components, the storage conditions to conserve the component’s properties shall be agreed between the manufacturer and the user.

6 Related issues

If the products in standard packaging do not fulfil the required quality and reliability goals under the shipment and storage conditions as described above, special actions shall be considered as described in IEC 60749, IEC/TS 61340-5-1 and IEC/TR 61340-5-2.

Annex A
(informative)

Transportation climatic conditions

For easy and rapid reference, this annex shows the content of the quoted conditions of IEC 60721-3-1 and IEC 60721-3-2.

NOTE The footnote references can be found on the last page.

Table A.1 – Transportation climatic conditions according to IEC 60721-3-2

Environmental parameter	Unit	Class		Conditions used in this standard instead of 2K2
		2K1	2K2	
a) Low air temperature	°C	+5	–25	–40
b) High air temperature, air in unventilated enclosures [1)]	°C	No	+60	
c) High air temperature, air in ventilated enclosures or outdoor air [2)]	°C	+40	+40	
d) Change of temperature, air/air [3)]	°C	No	–25/+25	–40/+30
e) Change of temperature, air/water [3)]	°C	No	No	
f) Relative humidity, not combined with rapid temperature changes	% °C	75 +30	75 +30	
g) Relative humidity, combined with rapid temperature changes: air/air at high relative humidity [3)]	% °C	No	No	
h) Absolute humidity, combined with rapid temperature changes: air/air at high water content [4)]	g/m³ °C	No	No	
i) Low air pressure	kPa	70	70	30
j) Change of air pressure	kPa/min	No	No	6
k) Movement of surrounding medium, air	m/s	No	No	
l) Precipitation, rain	mm/min	No	No	
m) Radiation, solar	W/m²	700	700	
n) Radiation, heat	W/m²	No	No	
o) Water from sources other than rain [5)]	m/s	No	No	
p) Wetness	None	No	No	

[1)] The high temperature of the surface of a product may be influenced by both the surrounding air temperature given here and the solar radiation through a window or other opening.

[2)] The high temperature of the surface of a product is influenced by the surrounding air temperature given here and the solar radiation defined below.

[3)] A direct transfer of the product between the two temperatures given is presumed.

[4)] The product is assumed to be subject to a rapid decrease of temperature only (no rapid increase). The figures of water content apply to temperatures down to the dew-point; at lower temperatures the relative humidity is assumed to be approximately 100 %.

[5)] The figure indicates the velocity of water and not the height of water accumulated.

Table A.2 – Transportation mechanical conditions according to IEC 60721-3-2

Environmental parameter	Unit	Class		
		2M1		
a) Stationary vibration, sinusoidal [1]:				
displacement amplitude	mm	3,5	-	-
acceleration amplitude	m/s^2	-	10	15
frequency range	Hz	2-9	9-200	200-500
b) Stationary vibration, random [1]				
acceleration spectral density	m^2/s^2	1	0,3	
frequency range	Hz	10-200	200-2 000	
c) Non-stationary vibration including shock [2]:				
shock response spectrum type I, peak acceleration	m/s^2	100		
shock response spectrum type II, peak acceleration	m/s^2	No		
d) Free fall:				
Mass less than 20 kg	m	0,25		
Mass 20 kg to 100 kg	m	0,25		
Mass more than 100 kg	m	0,1		
e) Toppling:				
Mass less than 20 kg	None	Toppling around any of the edges		
Mass 20 kg to 100 kg	None	No		
Mass more than 100 kg	None	No		
f) Rolling, pitching:				
Angle [3]	Degree	No		
Period	s	No		
g) Steady-state acceleration	m/s^2	20		
h) Static load	kPa	5		

[1] The frequency range may be limited to 200 Hz for transportation on parts of the vehicle with high internal damping.

[2] See Figure 1 in IEC 60721-3-2.

[3] An angle of 35° only occurs temporarily, but angles up to 22,5° can be reached for long periods of time.

Table A.3 – Storage conditions according to IEC 60721-3-1

Environmental parameter	Unit	Class	Conditions used in this standard instead of 1K2
		1K2	
a) Low air temperature	°C	+5	
b) High air temperature	°C	+40	
c) Low relative humidity [1)]	%	5	10
d) High relative humidity [1)]	%	85	75
e) Low absolute humidity [1)]	g/m^3	1	
f) High absolute humidity [1)]	g/m^3	25	
g) Rate of change of temperature [2)]	°C/min	0,5	
h) Low air pressure [3)]	kPa	70	
i) High air pressure [3)]	kPa	106	
j) Solar radiation	W/m^2	700	[6)]
k) Heat radiation	None	[7)]	
l) Movement of surrounding air [4)]	m/s	1,0 [8)]	
m) Condensation	None	No	
n) Precipitation (rain, snow, hail, etc.)	None	No	
o) Rain intensity	Mm/min	None	
p) Low rain temperature [5)]	°C	None	
q) Water from sources other than rain	None	No	
r) Formation of ice and frost	None	No	

1) The low and high relative humidities are limited by the low and high absolute humidities, so that, for example, for environmental parameters a) and c), or b) and d), the severities given in table do not occur simultaneously.

2) Averaged over a period of time of 5 min.

3) The value of 70 kPa represents a limit for open-air conditions, normally at an altitude of 3 000 m. In some geographical areas, open-air conditions may occur at higher altitudes. Conditions in mines are not considered.

4) A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.

5) This rain temperature should be considered together with high air temperature b) and solar radiation j). The cooling effect of the rain has to be considered in connection with the surface temperature of the product.

6) Exposure of the products to direct solar radiation should be avoided.

7) Conditions occurring at the location concerned to be selected: either 1Z1 = negligible, or 1Z2 = conditions of heat radiation, e.g. in the vicinity of room heating systems.

8) If applicable, a specific value may be selected either 1Z3 = 30 m/s or 1Z4 = 50 m/s.