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

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SURFACE MOUNTING TECHNOLOGY –

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FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61760-2:2007. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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

The text of this International Standard is based on the following documents:

Draft	Report on voting
91/1666/CDV	91/1708/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

Cross-references for references from this edition 3 to the previous edition 2 of this document are listed in Annex X of this document.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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SURFACE MOUNTING TECHNOLOGY –

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

1 Scope ~~and object~~

This International Standard ~~describes~~ specifies 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 document 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~~ can cause deterioration and result in assembly problems such as poor solderability, delamination and "popcorning".

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60721-3-1:2018, *Classification of environmental conditions – Part 3-1: Classification of groups of environmental parameters and their severities –: Storage*

IEC 60721-3-2:2018, *Classification of environmental conditions – Part 3-2: Classification of groups of environmental parameters and their severities –: Transportation and handling*

~~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 Terms and definitions

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

No terms and definitions are listed in this document.

4 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 and IEC TR 61340-5-5 ~~may~~ can contribute to the protection of components during transportation and storage.

If dry packing is specified and used, the IEC publications IEC 61760-4, IEC 60749-20-1 and IPC/JEDEC J-STD-033 should be consulted.

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

5 Transportation conditions

5.1 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 are according to IEC 60721-3-2:2018, class 2K12~~, except~~ Deviations from these conditions are listed below:

– 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; high relative humidity 75 %;

– no dripping water;

– no condensation is allowed.

The conditions are presented in tabular form in Annex A, Table A.1.

The total number of extreme temperature events (close to limits) should be limited to a minimum during transportation and storage.

Mechanical condition is according to IEC 60721-3-2:2018, class ~~2M1~~ 2M4. The condition is presented in tabular form, including a figure, in Annex A, Table A.2 and Figure A.1.

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 exceeding 10 days. (Total transportation time is time when products are not within controlled storage conditions.)

5.2 Special transportation conditions

5.2.1 General

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.

5.2.2 Category 1 (advised for all products)

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

Climatic conditions are according to IEC 60721-3-2:2018, class 2K11. Deviations from these conditions are listed below:

– low air temperature −40 °C;
– low relative humidity 10 %;
– high relative humidity 75 %;
– low air pressure 30 kPa.

The conditions are presented in tabular form in Annex A, Table A.1.

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 5.1.

5.2.3 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 5.1.

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

6 Storage conditions

Well controlled storage conditions are a major factor in problem prevention. Do not store in locations where the soldering properties can be deteriorated by harmful gases. Conditions that ~~may~~ can 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 are according to IEC 60721-3-1:2018, class 1K21~~, except~~.

Deviations from these conditions are listed below:

– low relative humidity 10 %;
– high relative humidity 75 %;
– solar radiation 700 W/m^2, but direct solar radiation should be avoided.

The conditions are presented in tabular form in Annex A, Table A.3.

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~~ shall 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 temperature and humidity conditions set out in this Clause 6.

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

7 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 in Clause 5 and Clause 6, special actions shall be considered as described in IEC 60749 (all parts), IEC~~/TS~~ 61340-5-1 and IEC TR 61340-5-2.

Considerations for risk mitigation, packaged component long-term storage and associated traceability, can be found in IEC 62435 (all parts).

Annex A
(informative)

Transportation ~~climatic~~ and storage conditions

For easy and rapid reference, this Annex A shows the content of the quoted conditions from IEC 60721-3-1:2018 and IEC 60721-3-2:2018.

The information is presented on following pages in tabular form in Table A.1, Table A.2 and Table A.3. In each table the deviations given in this document from conditions provided in IEC 60721-3-2 and from IEC 60721-3-1 are specified, if any.

Table A.1 – Classification of climatic conditions according to IEC 60721-3-2:2018, Table 1.

Table A.2 – Classification of mechanical conditions according to IEC 60721-3-2:2018, Table 5 and Figure 2.

Table A.3 – Storage conditions according to IEC 60721-3-1:2018, Table 1.

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.