

Space product assurance - High-reliability soldering for surface mount, mixed technology and hand-mounted electrical connections



## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 16602-70-61:2022 sisaldab Euroopa standardi EN 16602-70-61:2022 ingliskeelset teksti.	This Estonian standard EVS-EN 16602-70-61:2022 consists of the English text of the European standard EN 16602-70-61:2022.
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English version

## Space product assurance - High-reliability soldering for surface mount, mixed technology and hand-mounted electrical connections

Assurance produit des projets spatiaux - Soudure haute fiabilité pour les connexions électriques à montage en surface, à technologie combinée et montées à la main

Raumfahrtproduktsicherung - Hochzuverlässige Montage von Oberflächen-Befestigungen und Durchgangslochverbindungen

This European Standard was approved by CEN on 29 August 2022.

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## European Foreword

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This document (EN 16602-70-61:2022) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN (Germany).

This document (EN 16602-70-61:2022) originates from ECSS-Q-ST-70-61C.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 16602-70-38:2019; EN 16602-70-07:2014; EN 16602-70-08:2015.

This new ECSS Standard (ECSS-Q-ST-70-61C) was created by merging and updating the content of the following three standards:

- ECSS-Q-ST-70-07C “Verification and approval of automatic machine wave soldering”
- ECSS-Q-ST-70-08C “Manual soldering of high-reliability electrical connections”
- ECSS-Q-ST-70-38C Rev.1 “High-reliability soldering for surface-mount and mixed technology”

The intention of this completely new standard was to optimize the structure of the document, following the chronological order of assembly processes and introducing criterion for new technologies that were not covered by the three standards now superseded by this new standard.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and will therefore have precedence over any EN covering the same scope but with a wider do-main of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



# Introduction

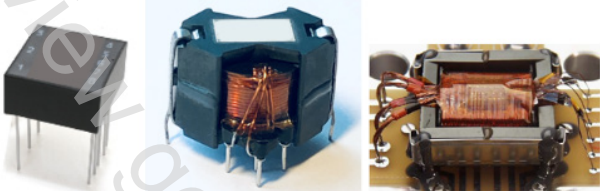
This document defines the technical requirements and quality assurance provisions for the manufacture and verification of high-reliability electronic circuits of surface mount, through hole, solderless assemblies, and soldering of harness and wire interconnection, for space applications, launchers, and associated equipment.

In the following table, principal types of through hole components and SMDs, including examples, can be gathered in the following families.

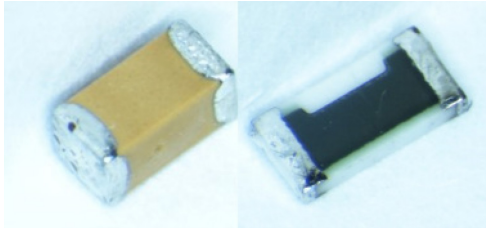
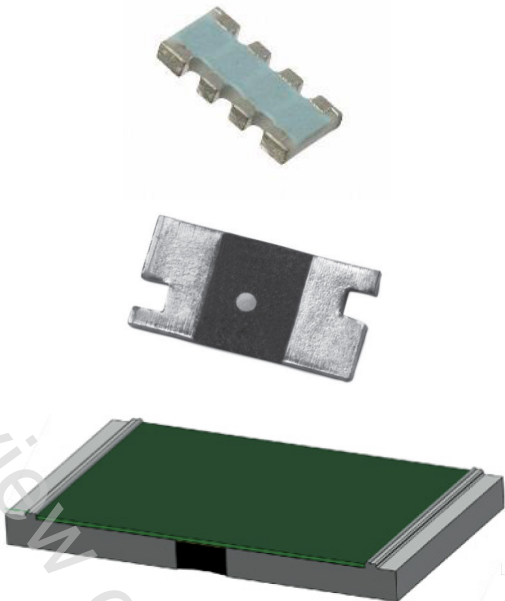

NOTE In the text of this document the term “component” is used instead of “device”.

THROUGH HOLE COMPONENTS (non exhaustive list)	
<b>Radial component</b> resistors capacitors fuses diodes	
<b>Axial component</b> Capacitors resistors diodes	
<b>Stacked capacitors</b> CH capacitors CNC capacitors	
<b>TO Metal Can package</b> TO-39	
<b>TO Metal tab package</b> TO254	




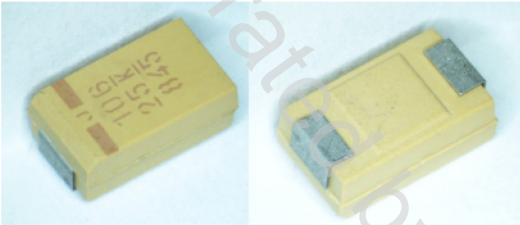



THROUGH HOLE COMPONENTS (non exhaustive list)	
<b>Dual in Line Package (DIL or DIP)</b> Side brazed DIP and DIL	
<b>Connectors</b>	
<b>Leaded magnetics</b> transformers with straight pins	
<b>Sculptured flex</b>	

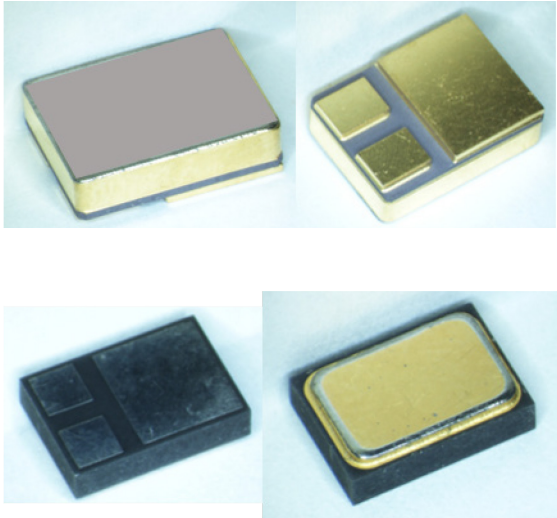
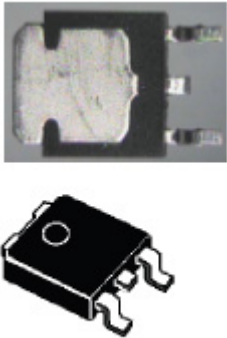
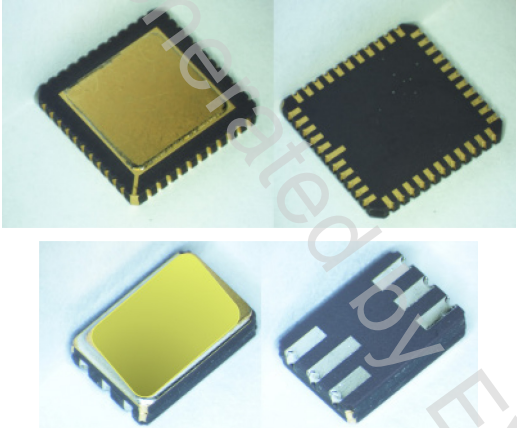



SMT COMPONENTS (non exhaustive list)	
<p><b>Rectangular and square end-capped or end-metallized component with rectangular body, leadless chip (see 10.4.2)</b></p> <p>ceramic end capped chip resistors and capacitors.</p> <p>ceramic resistors arrays</p> <p>metallic terminations fuses, thermistors CSM 2512</p> <p>metallic termination resistor SMS 2512</p>	 
<p><b>Cylindrical and square end-capped components with cylindrical or oval body, leadless chip (see 10.4.3)</b></p> <p>MELF for cylindrical end capped:</p> <ul style="list-style-type: none"><li>• Diodes in MELF, minimelf or micromelf</li></ul>	



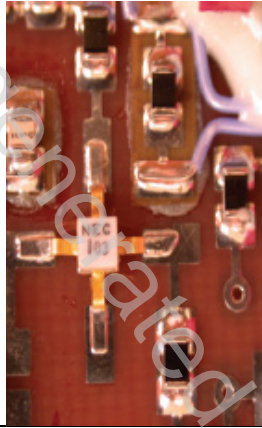
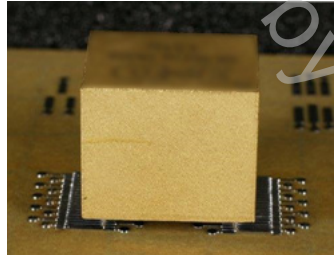


SMT COMPONENTS (non exhaustive list)	
<ul style="list-style-type: none"> <li>Resistors in MELF, minimelf or micromelf</li> </ul> <p>Square end capped:</p> <ul style="list-style-type: none"> <li>D- 5 family for square end capped with cylindrical or oval bodies</li> </ul>	 
<p><b>Bottom terminated chip component (see 10.4.4)</b></p> <p>This type of component has either metallised terminations on the bottom side or extended terminals from the bottom side.</p> <p>Chip inductors</p>	
<p><b>Component with inward formed L-shaped leads (see 10.4.5)</b></p> <p>moulded tantalum chip capacitors.</p> <p>SMD moulded shunt</p>	 



SMT COMPONENTS (non exhaustive list)	
<p><b>Leadless component with plane termination (see 10.4.6)</b></p> <ul style="list-style-type: none"> <li>- With metal plane termination: SMD0.5, SMD1, SMD2, SMD0.2*(TO276 JEDEC family denomination)</li> <li>- With non-metal plane termination: SMD0.2*</li> </ul> <p><b>*Package exists in two versions</b></p>	
<p><b>Leaded component with plane termination (see 10.4.7)</b></p> <p>Diode PackAge (DPAK or TO252)</p>	 <p>DPAK</p>
<p><b>Leadless castellated ceramic chip carrier component (see 10.4.8)</b></p> <p>The main component of this type is leadless ceramic chip carrier (LCCC)</p> <p>LCC6</p>	
<p><b>No lead QFN (see 10.4.9)</b></p> <p>quad flat pack no leads</p>	



SMT COMPONENTS (non exhaustive list)	
<p><b>Flat pack and gull-wing leaded component (see 10.4.10)</b></p> <p>small-outline transistor (SOT), small-outline package (SO), flat pack and quad flat pack (QFP) and SMD connectors with stress-relief (MHD).</p> <p>transformers</p> <p>Components with both flat rectangular and round leads are included in this group. The components can be delivered either with pre-formed leads or with straight leads which will be then in-house preformed by the user.</p>	
<p><b>“J” leaded component (see 10.4.11)</b></p> <p>ceramic leaded chip carriers (CLCC) and plastic leaded chip carriers (PLCC).</p>	
<p><b>Components with ribbon terminals without stress relief (flat lug leads) (see 10.4.12)</b></p> <p>This package has flat leads extending from the sides</p>	
<p><b>Stacked modules components with leads protruding vertically from bottom (see 10.4.13)</b></p>	



SMT COMPONENTS (non exhaustive list)	
<p><b>Area array components (AAD) (see 10.4.14)</b></p> <p>Components connected via an array of solder columns (Column Grid Array - CGA), solder balls (Ball Grid Array - BGA) or directly to the board (Land Grid Array - LGA).</p> <p>The columns and balls consist of various types of solder with wide-ranging properties.</p>	<div></div> <div><div>CGA</div><div>BGA</div><div>LGA</div></div>
<p><b>Solderless connection (see 10.7)</b></p> <p>solderless connectors</p>         <p>solderless interposers for LGA or connectors</p>	<div></div> <div></div>



# 1

## Scope

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This Standard defines the technical requirements and quality assurance provisions for the manufacture and verification of high-reliability electronic circuits of surface mount, through hole, solderless assemblies and soldering of harness and wire interconnection.

The Standard defines workmanship requirements, the acceptance and rejection criteria for high-reliability assemblies intended to withstand ground testing conditions including LTS (long term storage) and the environment imposed by space flight and launchers.

The mounting and supporting of components, terminals and conductors specified in this standard applies only to assemblies designed to continuously operate over the mission within the temperature limits of -55 °C to +85 °C at solder joint level.

Requirements related to printed circuit boards are contained in ECSS-Q-ST-70-60 and ECSS-Q-ST-70-12.

This standard does not cover lead-free soldering and associated requirements.

This Standard does not cover the qualification and acceptance of the EQM and FM equipment with high-reliability electronic circuits of surface mount, through hole and solderless assemblies.

This Standard does not cover verification of thermal properties for component assembly.

This Standard does not cover pressfit connectors due to the possible damage in the PCB that is not evaluated within this test requirement.

The qualification and acceptance tests of equipment manufactured in accordance with this Standard are covered by ECSS-E-ST-10-03.

This standard may be tailored for the specific characteristics and constraints of a space project, in accordance with ECSS-S-ST-00.



## Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system - Glossary of terms
EN 16601-40	ECSS-M-ST-40	Space project management - Configuration and information management
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance - Nonconformance control system
EN 16602-20	ECSS-Q-ST-20	Space product assurance - Quality assurance
EN 16602-60	ECSS-Q-ST-60	Space product assurance - Electrical, electronic and electromechanical (EEE) components
EN 16602-60-05	ECSS-Q-ST-60-05	Space product assurance - Generic requirements for hybrids
EN 16602-60-13	ECSS-Q-ST-60-13	Space product assurance - Commercial electrical, electronic and electromechanical (EEE) components
EN 16602-70	ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance - Cleanliness and contamination control
EN 16602-70-02	ECSS-Q-ST-70-02	Space product assurance - Thermal vacuum outgassing test for the screening of space materials
EN 16602-70-12	ECSS-Q-ST-70-12	Space product assurance - Design rules for printed circuit boards
EN 16602-70-28	ECSS-Q-ST-70-28	Space product assurance - Repair and modification of printed circuit board assemblies for space use
EN 16602-70-60	ECSS-Q-ST-70-60	Space product assurance -Qualification and procurement of printed circuit boards
EN 16602-70-71	ECSS-Q-ST-70-71	Space product assurance -Materials processes and their data selection
	EN 61340-5-1:2016	Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements



	ESA-STR-258	ESA-Approved Skills Training Schools - Electronic Assembly Techniques
	ESCC 23500 (September 2013)	Requirements for lead materials and finishes for components for space application
	IPC J-STD-001H (September 2020)	Requirements for Soldered Electrical and Electronic Assemblies
	IPC J-STD-004B-AM1 (November 2011)	Requirements for Soldering Fluxes
	IPC J -STD-033D (January 2018)	Handling, Packing, Shipping and Use of Moisture, Reflow, and Process Sensitive Devices
	IPC-TM-650 (Latest edition)	Test methods manual
	ISO 9454-1:2016	Soft soldering fluxes — Classification and requirements — Part 1: Classification, labelling and packaging
	ISO 14644-1:2015	Cleanrooms and controlled environments — Part 1: Classification of air cleanliness by particle concentration
	MIL-STD-883 K Method 2009 (April 2016)	Test Method Standard, Microcircuits