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**Zagotavljanje varnih proizvodov v vesoljski tehniki - Zmanjšanje števila
komponent EEE**

Space product assurance - Derating - EEE components

Raumfahrtproduktsicherung - Herabsetzen/Unterlastung von EEE-Komponenten

Assurance produit des projets spatiaux - Détarage des composants EEE

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Space product assurance - Derating - EEE components

Assurance produit des projets spatiaux - Détarage des
composants EEERaumfahrtproduktsicherung -
Herabsetzen/Unterlastung von EEE-Komponenten

This European Standard was approved by CEN on 5 December 2021.

CEN and CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN and CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European Foreword

This document (EN 16602-30-11:2021) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN (Germany).

This document (EN 16602-30-11:2021) originates from ECSS-Q-ST-30-11C Rev.2.

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of an identical text or by endorsement, at the latest by June 2022, and conflicting national standards shall be withdrawn at the latest by June 2022.

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 16602-30-11:2014.

The main changes with respect to EN 16602-30-11:2014 are listed below:

- Implementation of Change Requests
- Addition of clause 6.26.2.9 "Thick Film Power"
- Informative Annex B "ESCC Exceptions" deleted
- Informative Annex C "Example of single wires rating currents calculation for the wires most commonly used for space applications" added

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 has therefore precedence over any EN covering the same scope but with a wider domain 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, Turkey and the United Kingdom.

Introduction

This Standard specifies derating requirements applicable to electronic, electrical and electromechanical components.

Derating is a long standing practice applied to components used on spacecraft. Benefits of this practice are now proven, but for competitiveness reasons, it becomes necessary to find an optimized reliability. Too high a derating can lead to over-design, over-cost and over-sizing of components, the direct consequence being excess volume and weight. The aim is to obtain reliable and high performance equipment without over-sizing of the components. For this reason and if possible, this Standard provides derating requirements depending on mission duration and mean temperature, taking into account demonstrated limits of component capabilities.

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Scope

This Standard applies to all parties involved at all levels in the realization of space segment hardware and its interfaces.

The objective of this Standard is to provide customers with a guaranteed performance and reliability up to the equipment end-of-life. To this end, the following are specified:

- Load ratios or limits to reduce stress applied to components;
- Application rules and recommendations.

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

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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 revisions 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 most 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 16602-60	ECSS-Q-ST-60	Space product assurance - Electrical, electronic and electromechanical (EEE) components
EN 16602-60-13	ECSS-Q-ST-60-13	Commercial electrical, electronic and electromechanical (EEE) components
EN 16602-60-15	ECSS-Q-ST-60-15	Radiation hardness assurance - EEE components
	ESCC 2269010	Evaluation test programme for monolithic microwave integrated circuits (MMICS)
	ESCC 2265010	Evaluation Test Programme for Discrete Microwave Semiconductors
	ESCC Derating deviations	Component Derating - Deviations to ECSS-Q-ST-30-11: https://escies.org/webdocument/showArticle?id=825&groupid=6

Terms, definitions and abbreviated terms

3.1 Terms from other standards

- a. For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01 apply.
 1. component
 2. derating
 3. performance

3.2 Terms specific to the present standard

3.2.1 **ambient temperature**

temperature surrounding a component
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3.2.2 **bundle**

set of two or more wires arranged in parallel, tied or laced together.

3.2.3 **case temperature**

temperature on the component package surface

3.2.4 **hot spot temperature**

highest measured or predicted temperature within any component

3.2.5 **junction temperature**

highest measured or predicted temperature at the junction within a semiconductor or micro-electronic device

NOTE Predicted temperature can be taken as $T_{\text{case}} +$ thermal resistance between junction and case times actual power (Watt) of the device.

3.2.6 load ratio

permissible operating level after derating has been applied; given as a percentage of a parameter rating

3.2.7 operating conditions

parameter stress and environment (temperature, vibration, shock and radiation) in which components are expected to operate

3.2.8 rating

maximum parameter value specified and guaranteed by the component manufacturer and component procurement specification

NOTE Rating is considered as a limit not to be exceeded during operation and constitutes in most cases the reference for derating.

3.2.9 surge

strong rush or sweep

3.2.10 transient

brief change in the state of a system

3.3 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
A/D	analog to digital
ASIC	application specific integrated circuit
C	capacitance
DRAM	dynamic random access memory
EEPROM	electrical erasable programmable read only memory
EPROM	erasable programmable read only memory
ESCC	European Space Component Coordination
ESR	equivalent series resistance
f	frequency
FET	field effect transistor
GaAs	gallium arsenide
ISO	International Organization for Standardization

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Abbreviation	Meaning
InP	indium phosphide
LED	light emitting diode
MOS	metal on silicon
MIL (spec)	specification of the US Department of Defense
MMIC	monolithic microwave integrated circuit
NASA	National Aeronautics and Space Administration
P	power
PROM	programmable read only memory
RadHard	radiation hardened
Ri	insulation resistance
RF	radio-frequency
SEBO	single event burn-out
SEGR	single event gate rupture
Si, SiGe	silicon, silicon germanium
SOA	safe operating area
SRAM	static random access memory
T _j	junction temperature
T _{jmax}	absolute maximum rated junction temperature
T _{op}	operating temperature
V _{CE}	collector-emitter voltage

3.4 Nomenclature

The following nomenclature applies throughout this document:

- The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.
- The word “should” is used in this Standard to express recommendations. All the recommendations are expressed with the word “should”.

NOTE It is expected that, during tailoring, recommendations in this document are either converted into requirements or tailored out.

- The words “may” and “need not” are used in this Standard to express positive and negative permissions, respectively. All the positive

permissions are expressed with the word “may”. All the negative permissions are expressed with the words “need not”.

- d. The word “can” is used in this Standard to express capabilities or possibilities, and therefore, if not accompanied by one of the previous words, it implies descriptive text.

NOTE In ECSS “may” and “can” have completely different meanings: “may” is normative (permission), and “can” is descriptive.

- e. The present and past tenses are used in this Standard to express statements of fact, and therefore they imply descriptive text.

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