



**TERMS, DEFINITIONS, ABBREVIATIONS,
SYMBOLS AND UNITS**

ESCC Basic Specification No. 21300

Issue 4	September 2013
---------	----------------



LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2013. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

DOCUMENTATION CHANGE NOTICE

(Refer to <https://escies.org> for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
799	Specification upissued to incorporate editorial changes per DCR.

TABLE OF CONTENTS

1	SCOPE	5
2	TERMS AND DEFINITIONS FOR GENERAL PURPOSES	5
2.1	BASIC TERMS	5
2.1.1	Classification	5
2.1.2	Specifications	6
2.1.3	Procedure	6
2.2	RELIABILITY CONCEPTS	8
2.2.1	Reliability	8
2.2.2	Failure Concepts	8
2.2.3	Test Concepts	10
2.3	QUALITY ASSURANCE TERMS	11
2.3.1	General	11
2.3.2	Statistics, Sampling and Testing	11
2.3.3	Inspection	13
2.3.4	Documents	14
2.4	IRRADIATION TERMS	16
2.4.1	Irradiation In Orbit	16
2.4.2	Irradiation Resistance Testing	16
2.4.3	The Basic Definitions	16
2.4.4	Expressions used in ESCC Basic Specification No. 22900	16
3	ABBREVIATIONS, SYMBOLS AND UNITS FOR GENERAL PURPOSES	17
3.1	CURRENTS, VOLTAGES AND POWERS	17
3.2	SUBSCRIPTS	17
3.3	LETTER SYMBOLS FOR ELECTRICAL PARAMETERS	17
3.4	SUBSCRIPTS FOR ELECTRICAL PARAMETERS	18
3.5	LETTER SYMBOLS FOR TEMPERATURE	18
3.6	OTHER SYMBOLS	18
3.7	STANDARD VALUES	18
4	ANCILLARY BASIC SPECIFICATIONS	19
	APPENDIX 'A'	20

1 SCOPE

This specification defines the terms, definitions, abbreviations, symbols and units used in the ESCC Basic, Generic and Detail Specifications which together form the overall ESCC System.

Terms, definitions, abbreviations, symbols and units used for, and applicable to, individual components only are defined in ancillary Basic Specifications belonging to the 21300 series of specifications (see Section 4).

Each Basic Specification shall be read in conjunction with this specification.

A component Detail Specification may also include other specific or unique abbreviations and symbols which will be defined within the applicable section of the Detail Specification itself.

2 TERMS AND DEFINITIONS FOR GENERAL PURPOSES

2.1 BASIC TERMS

2.1.1 Classification

ESCC Component

- A component which may have the benefit of ESCC qualified status by virtue of at least the quality operations (e.g. inspections and tests), as defined in the ESCC Specifications, being performed in one or more, and the delivered component originating from one, of the Member States of ESA or a state or country with a cooperation agreement with ESA. The component shall be freely available to the User Industry on a commercial basis without let or hindrance, inter alia being free from any form of selective export controls.

Family of Components

- A group of components which display a particular and predominant physical characteristic and/or fulfil a specific function.

Family of Structurally Similar Components

- A family of components that are structurally similar, but separately identifiable, covered by a single Detail Specification. Such components shall be produced by one Manufacturer, consist of essentially the same materials and be manufactured according to the same basic design, processes and techniques. They shall differ only in electrical characteristics.

Subfamily of Components

- A group of components belonging to the same component family and produced according to similar technological methods.

Type and Style

- Type and style of a specific component are defined in the relevant Detail Specification.

Capability Domain

- A set of defined technologies subjected to Capability Approval review and limited by the capability boundaries.

- Capability Boundary
- One of the electrical, physical or mechanical parameters, design rules, materials, equipment or software forming the limits of the capability domain. These boundaries are proved initially and defined, by the Manufacturer, in the Process Identification Document.
- 2.1.2 Specifications
- Specification
- A document containing the rules and requirements, including inspection procedures, applicable to component procurement.
- Basic Specification
- Such specification is applicable to all component families or a large group of components to the extent specified in the applicable Generic or Detail Specification.
- Generic Specification
- A specification applicable to a family or subfamily of components and containing all those requirements that are common to a component family or subfamily.
- Detail Specification
- A specification derived from a Generic Specification which covers a particular component or a recognised range of components. It describes that component, or range of components, together with rated and/or limit values and characteristics. A Detail Specification also includes inspection requirements or refers in respect of such requirements to the applicable Generic Specification.
- 2.1.3 Procedure
- Approval of a Manufacturer
- A procedure which results in the recognition that a Manufacturer has a competent organisation for the production and inspection of particular components in accordance with the requirements laid down in ESCC Basic Specifications.
- Qualification Approval
- Qualification approval is the decision by the proper authority that a particular Manufacturer can be considered as able to produce reasonable quantities of the component type which meets the specification requirements.
- Raw Material Lot
- The material has to be manufactured:
 - With the same process, specifications and procedures.
 - With the same equipment.
- Diffusion Lot
- Wafers shall be processed within an uninterrupted period of 6 weeks:
 - With wafer raw material from the same crystal.
 - With the same process, specifications and procedures (diffusion).
 - With the same design, construction and geometry (mask).
 - With the same equipment.

Wafer Lot	– A wafer lot consists of wafers formed into a lot at the start of wafer fabrication for homogeneous processing as a group derived from the same materials, which has been assigned a unique identifier or code to provide traceability and maintain lot integrity throughout a uniform fabrication process.
Piece Parts Lot	– The piece parts have to be manufactured: <ul style="list-style-type: none">– With the same process, specifications and procedures.– With the same design, construction and geometry.– With the same equipment.
Assembly Lot	– An assembly lot is a quantity of components or family of structurally similar components which, as well as their piece parts are manufactured: <ul style="list-style-type: none">– With semiconductor dice out of one diffusion lot.– With basic raw material out of one raw material lot.– With piece parts out of one piece parts lot.– Through to the end of Final Production Tests.– With the same process, specifications and procedures.– With the same design, construction and geometry.– With the same equipment.
Inspection Lot	– A quantity of components presented for inspection and submission to lot-by-lot testing in accordance with the sampling document.
Delivery Lot	– A quantity of components delivered against an order and originating from the same assembly lot. It can include flight parts and Qualification/Lot Acceptance Test samples.
Selected Sublot	– A portion of an assembly lot, if the assembly lot comprises more units than are required for mechanical, environmental and endurance tests and delivery. A selected sublot shall consist of a minimum of the components necessary for delivery, test sublot and allowable failures during burn-in. More than one selected sublot can be extracted from an assembly lot.
Test Sublot	– A test sublot consists of those components that are required for the performance of mechanical, environmental and endurance tests according to the applicable Generic Specification. Such components shall be randomly taken from a selected sublot after successful completion of burn-in and parameter drift screening.
Deliverable Components	– Components to be delivered shall be processed and inspected according to the production flow chart and shall pass all tests specified for the required testing level.
Certificate of Conformity	– A document issued with a delivery lot, stating that the components have been taken from one or more inspection lots released in conformity with ESCC basic rules.
Mark of Conformity	– A mark applied to the packing and/or component, indicating that the components originate from an inspection lot which has been released in accordance with ESCC basic rules.

- Capability Approval – An approval granted to a Manufacturer when it has been established that his capability for design, manufacture and quality control of products, within a defined technological domain, fulfils ESCC requirements.
- Chip Component – A component in its ultimate state of miniaturisation.
- Test Structure – An element or component specifically intended to test one or more Parametric boundaries of the capability domain and used in testing to obtain Capability Approval.

2.2 RELIABILITY CONCEPTS

2.2.1 Reliability

Reliability (general definition)

- The ability of an item to perform a required function under stated conditions and for a stated period of time.

Reliability (probability definition)

- The characteristic of an item expressed by the probability that it will perform a required function under stated conditions and for a stated period of time.

2.2.2 Failure Concepts

Failure

- The termination of the ability of an item to perform its required function, or excessive change of any characteristic of an item, or the loss of traceability of an item.
A failure may be effected by inherent weakness of a component during operation or storage within rated conditions, or by wrong handling of a component, of insufficient or wrong documentation during manufacturing, testing, storage or shipping.

Failure Mode

- The effect by which a failure is observed.

Sudden Failure

- A failure that could not be anticipated by prior examination.

Gradual Failure

- A failure that could be anticipated by prior examination.

Partial Failure

- A partial failure shall be identified as a drift or limit failure.

Drift Failure

- A failure resulting from deviation in characteristic(s) beyond the specified parameter drift values, during burn-in and parameter drift screening tests, but not causing complete failure of the required function.

Limit Failure

- A failure resulting from deviation in characteristic(s) beyond the specified limits and causing failure of the required function.

Complete Failure

- A failure resulting from deviations in characteristic(s) beyond specified limits causing loss of the required function.

Catastrophic Failure

- A failure which is both sudden and complete.

Degradation Failure

- A failure which is both gradual and partial.

Early Failure Period	– The early stages of a period which starts at a specified point in time and during which the failure rate decreases rapidly.
Constant Failure Rate Period	– A period during which it is possible that failures occur at an approximately uniform rate.
Wear-out Failure Period	– A period during which it is possible that the failure rate increases rapidly due to deterioration processes.
Mean Failure Rate	– A quantity of items which is related to a time unit and which, having survived up to an arbitrary instant, are no longer active at the instant $t+\Delta t$. The instantaneous mean failure rate is equal to the density of the conditional probability of failure.
Mean Time to Failure – MTTF	– For truncated tests and during a defined life period of an item, the sum of the operating time of a population, divided by the total number of failures in the population during the period in given stress conditions (cumulative operating time is a product or sum of products).
Mean Time Between Failures- MTBF	– For a stated period in the life of an item, the mean value of the duration of operating times between consecutive failures under given stress conditions.
Mean Life Observed	– Mean value of observed times to failure of all the individuals in a population of items under stated conditions.
Failure Analysis – FA	– The logical, systematic examination of an item or its diagram(s) to identify and analyse the probability, causes and consequences of potential and real failures.
Defect	– The nonfulfillment of an intended ESCC requirement or a reasonable expectation, for the use of a component, including one concerned with safety.
Minor Defect	– A defect that is not likely to reduce materially the usability of the unit of product for its intended purpose or its departure from established standards, having little bearing on the effective use or operation of the unit.
Minor Defective	– A unit of product that contains one or more defects, but contains no critical or major defect.
Non-conformance	– The failure of a unit of product to conform to specified requirements for any quality characteristic.

2.2.3 Test Concepts

- | | |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Qualification Test | – Qualification of a product is a complete series of tests carried out on a number of specimens representative of the type with the object of determining whether a particular Manufacturer can be considered capable of manufacturing products which meet the specification. |
| Screening Test | – A test, or combination of tests, imposed on 100% of the parts, intended to remove unsatisfactory items or those likely to exhibit early failures. |
| Burn-in | – All test and measurement operations which are performed on all of the assembled (finished) components. |
| Final Production Test - FPT | – Non-destructive testing to stabilise the characteristics of an assembly lot and to screen good parts without either effective or potential failures. |
| Environmental and Endurance Tests | – The testing (destructive or non-destructive) of samples for product qualification purposes. Such testing may include: <ul style="list-style-type: none">– Shock.– Vibration.– Constant acceleration.– Seal.– Weldability.– Solderability.– Thermal shock.– Moisture resistance.– Terminal strength.– Electrical measurements.– Operating life.– High temperature storage. |
| Extended Endurance Test | – Extended endurance tests are tests required to obtain information about the reliability of a component. They may include: <ul style="list-style-type: none">– Operating life, i.e. 10000 hours– High temperature storage for a long time, i.e. 10000 hours. |
| Destructive Physical Analysis - DPA | – Determination of the type and quality of materials, technology and processes used by a Manufacturer in the production of a particular component to establish its suitability for Space applications, or to maintain the standard of approved materials, technology and processes. |

2.3 QUALITY ASSURANCE TERMS

2.3.1 General

Quality

- The totality of characteristics of an item or component that bear on its ability to satisfy stated and implied needs.

Quality Assurance - QA

- A planned and systematic pattern of all actions necessary to provide adequate confidence that the item or product conforms to established technical requirements.

Quality Control - QC

- A management function whereby control of quality of raw or produced material is exercised for the purpose of preventing production of defective material.

Qualification

- The entire process by which products are obtained from Manufacturers or Distributors, examined and tested, and then identified in Qualified Product Lists.

Qualified Part

- A component type which has been demonstrated to meet the ESCC requirements for inclusion in the ESCC Qualified Parts List.

Safety

- The state in which the risk of harm (to persons) or damage arising from component handling or intended use is limited to an acceptable level.

2.3.2 Statistics, Sampling and Testing

Acceptable Quality Level (AQL)

- The maximum percentage of defectives (or the maximum number of defects per 100 units) which, for the purpose of sampling inspection, can be considered satisfactory as a process average.

Acceptance Number

- The maximum number of defects or defective units in a sample that will permit acceptance of the inspection lot or batch.

Rejection Number

- The minimum number of defects or defective units in a sample that will cause rejection of the lot represented by the sample.

Defects per 100 Units

- The number of defects per 100 units of any given quantity of a product is the number of defects contained therein divided by the total number of units of product, the quotient multiplied by 100 (1 or more defects being possible in any unit of product). Expressed as an equation:

$$\text{Defects per 100 units} = \text{Number of defects} \times 100 / \text{Number of Units}$$

Inspection Level	– An indication of the relative sample size for a given amount of product.
Inspection Tightened	– Inspection under a sampling plan using the same quality level as for normal inspection, but requiring more stringent acceptance criteria.
Reduced Inspection	– Inspection under a sampling plan, using the same quality level as for normal inspection, but requiring a smaller sample for inspection.
100% Inspection	– Inspection in which specified characteristics of each unit of product are examined or tested to determine conformance to requirements.
Percent Defective Allowable - PDA	– The allowable percent defective of any given quantity of units of product is 100 times the number of defective units of product contained therein divided by the total number of units of product, i.e.: $\text{Allowable percent defective} = \frac{\text{Number of defectives} \times 100}{\text{Number of units inspected}}$
Process Average	– Is the average percentage of defective or average number of defects per 100 units of product submitted by the supplier for original inspection.
Lot or Batch	– The term lot or batch shall mean "inspection lot" or "inspection batch", i.e. a collection of electronic components from which a sample is to be drawn and inspected to determine compliance with the acceptability criteria, and may differ from a collection of electronic components designated as a lot or batch for other purposes (e.g. production, shipment, etc.)
Lot Size	– The number of units of product in a lot.
Sample	– A sample consists of 1 or more electronic components from a lot or batch, the units of the sample being selected at random. The number of electronic components in the sample is the sample size.
Sample Size	– The number of units of product in the sample selected for inspection.
Sample Unit	– A unit of product selected to be part of a sample.
Unit of Product	– A unit of product is the thing inspected in order to determine its classification as defective or non-defective or to count the number of defects. It may be a single article, a pair, a set, a length, an area, an operation, a volume, a component of an end product, or the end product itself. The unit of product may, or may not, be the same as the unit of purchase, supply, production or shipment.

- Sampling Frequency – The sampling frequency 'f' is the ratio between the number of units of product randomly selected for inspection at an inspection to the number of product passing the inspection station.
- Sampling Plan – A statement of the sample size or sizes to be used and the associated acceptance and rejection criteria.
- Resubmitted Lot – A lot which has been rejected, subjected to either examination or testing, or both, for the purpose of removing all defective units which may or may not be reworked or replaced, and submitted again for acceptance.
- Testing – Is an element of inspection and generally denotes the determination by technical means of the properties of elements of supplies, or components thereof, including functional operation, and involves the application of established scientific principles and procedures.
- Testing Levels – Testing levels are identifiable qualities of components arrived at by prescribing the determination of testing. Testing level 'B' is the highest defined level.
- 2.3.3 Inspection
Calibration – Comparison of 2 instruments or measuring devices, 1 of which is a standard of known accuracy traceable to national standards, to detect, correlate, report or eliminate by adjustment any discrepancy in accuracy of the instrument or measuring device being compared with the standard.
- Measuring and Test Equipment – All devices used to measure, gauge, test, inspect, diagnose or otherwise examine materials, supplies and equipment to determine compliance with technical requirements.
- Attribute – A characteristic or property which is appraised in terms of whether it does or does not exist (e.g. go or not go) with regard to a given requirement.
- Inspection – The examination and testing of supplies and services (including, when appropriate, raw materials, components and intermediate assemblies) to determine whether they conform to specified requirements.
- Lot-by-lot Inspection – Lot-by-lot inspection is that inspection carried out on each lot either on a sample drawn from the lot or on the complete lot. The results of tests in this category are used to determine whether the lot complies with the specified requirements.

- Periodic Inspection
- Periodic inspection is that inspection carried out periodically on a sample drawn either from an individual lot or from a number of lots. The lot(s) from which the sample is drawn shall have been shown to comply with the requirements for lot-by-lot inspection. The results from tests in this category are used to verify that the level of technical performance is being maintained.
- Inspection by Attribute
- Inspection whereby either the unit of product or characteristic thereof is classified simply as defective or non-defective, or the number of defects in the unit of product is counted, in respect of a given requirement.
- Inspection by Variables
- Inspection wherein certain quality characteristics of sample are evaluated in respect of a continuous numerical scale and expressed as precise points along this scale. Variables inspection records the records the degree of conformance or non-conformance of the unit with specified requirements for the quality characteristics involved.
- Inspection In-process
- Inspection which is performed during the manufacturing or repair cycle in an effort to prevent defectives from occurring and to inspect the characteristics and attributes which are not capable of being inspected at final inspection.
- Examination
- An element of inspection consisting of investigation, without the use of special laboratory appliances or procedures, of supplies and services to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally non-destructive and includes, but is not limited to, visual, auditory, olfactory, tactile, gustatory and other investigations; simple physical manipulations; gauging; and measurement.
- Traceability
- The means of knowing at all times during production or a specific period of utilisation of a component any historical detail of each production and reliability processing step, starting from the raw materials source, the inspector or worker, the state of the machine, etc.
- 2.3.4 Documents
- Inspection Record
- Recorded data concerning the results of inspection action.
- Deviation
- Written authorisation, granted prior to the manufacture of an item, to depart from a particular performance or design requirement of a contract, specification or referenced document, for a specific number of units or specific period of time.
- Waiver
- A written authorisation to accept a configuration item or other designated items which, during production or after having been submitted for inspection, are found to depart from specified requirements, but nevertheless are considered suitable for use "as is" or after rework by an approved method.

- Inspection Quality Conformance – All examinations and tests performed on items or services for the purpose of determining conformance with specified requirements.
- Certificate of Conformance – A Contractor's written statement, when authorised by contract, certifying that supplies or services comply with contract requirements.
- Production Flow Chart – The production flow chart is a drawing which shows the overall processing and testing, the manufacturing sequences of a particular part of production line, including inspection and process control points.
- N.B.**
Essential elements of the production flow chart are as follows:
- Raw materials.
 - Processing steps.
 - Inspection.
 - Reference to all corresponding specifications with revision letter or number.
- Overall Flow Chart – The overall flow chart is a drawing which includes a simplified production flow chart, sequences of testing operations, indication of recorded data and documents to be delivered.
- Qualified Parts List - QPL – The qualified parts list is a list of components and materials accepted under the ESCC Specification System, including the names and plant addresses of Manufacturers or distribution.
- Survey, Product-oriented – A review and evaluation to determine the adequacy of the technical requirements relating to quality and product conformance to design intent.
- Authorised Representatives – Representatives authorised in accordance with the Space Agency rules to act on its behalf in the National and European component fields.
- Qualifying Space Agency - QSA – The qualifying space agency is the national authority recognised by the ESCC Executive.
- Process Identification Document - PID – A Process Identification Document comprises all documents relevant to the manufacture of a specific component. It shall include, as a minimum:
- (a) The production flow chart.
 - (b) All process specifications.
 - (c) All inspection procedures.
 - (d) Constructional details of the component, including photographs where applicable.
 - (e) The test programme.
 - (f) An organigram of the Manufacturer's organisation.

Capability Abstract

- A comprehensive synopsis of a capability domain in terms of technology boundaries, circuit function and performance, construction rules, package and design data etc. The document shall have no commercial sensitivity, thus rendering it suitable for inclusion in the Qualified Products List.

2.4 IRRADIATION TERMS

2.4.1 Irradiation In Orbit

The main influence on electronic components will be caused by:

- High energy electrons.
- Protons.
- Heavy ions.
- X-ray.
- Gamma ray.

2.4.2 Irradiation Resistance Testing

To assure the correct behaviour of a semiconductor device in a Space radiation environment, it is advisable to check its vulnerability to this environment by radiation stress testing in the laboratory. An exact radiation profile with all its different components and wide energetic spectrum cannot be duplicated in the laboratory. Instead of this, the influence of the radiation species, their energy and also the influence of the response of the semiconductor material and technology can be determined by experiments.

Though the particle type and dose rate, that may prevail, are disregarded, it is possible to determine behaviour under irradiation by dosage from a single radiation source. The effects of such a total dose bear a rough approximation to actual conditions for doses from approximately 1kRad up to 1MRad.

2.4.3 The Basic Definitions

The source of these definitions, units and parameters that are internationally accepted is IEC Publication 50:

- RAD: A dose of one RAD imparts 100 ERG of ionising excitation energy per gramme of material irradiated; 1 RAD (Si) = 100 ERG/g (Si).
- GRAY (GY): 1 Joule/kg (100RAD).
- DOSE LEVEL: In RAD (material); 1RAD (Si) = 100 ERG/g (Si).
- DOSE RATE: In RAD (material)/sec.
- FLUENCE: Particles/cm².
- FLUX: Particles/cm²/sec.

2.4.4 Expressions used in ESCC Basic Specification No. 22900

- Co 60 Source: A source with a steady state dose.
- Steady State Irradiation Testing: Testing the irradiation resistance of a component under a steady state (non-pulsating) source (A Cobalt 60 source for example).

- Total Dose Ionising Radiation: The amount of radiation that is absorbed by the component under test, expressed in RAD (Si) or GRAY (Si).
- In-situ Testing: Electrical testing of the component on the location where the component is irradiated.
- Remote Testing: Electrical testing of the component on another location than where the component is irradiated.
- Dosimetry: A method to measure the deposited energy or particle fluence in order to quantify the steady state radiation exposure.
- Faraday Cup: The most widely used instrument for monitoring the FLUX and FLUENCE and for absolute determination of charged particle fluxes. The total charge built up on the Faraday Cup divided by the charge per particle gives the total number of particles which have fallen on the cup.
- Device Biasing: The device under test has an outside voltage supplied during irradiation exposure.
- Unidirectional Incident Radiation: Exposure to a parallel (collimated) beam of radiation.
- Corrections for Source Decay: The irradiating source will change its fluence in time. Co-60 sources have a decrease with a half life of approximately 5 years.
- Annealing: Recovery of certain devices after removal of the irradiation source. This recovery to normal situation is called annealing.

3 ABBREVIATIONS, SYMBOLS AND UNITS FOR GENERAL PURPOSES

3.1 CURRENTS, VOLTAGES AND POWERS

I, i = Current	A = Ampère
V, v = Voltage	V = Volts
P, p = Power	W = Watts

3.2 SUBSCRIPTS

AV, av = Average

F, f = Forward.

3.3 LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

<u>Symbol</u>	<u>Definition</u>	<u>Unit</u>
B, b	= Susceptance	mhos
C	= Capacitance	Farad
G, g	= Conductance	mhos
H, h	= Hybrid parameter	
L	= Inductance	Henry
R, r	= Resistance	Ohm
X, x	= Reactance	Ohm

Y, y = Admittance mhos

Z, z = Impedance Ohm

3.4 SUBSCRIPTS FOR ELECTRICAL PARAMETERS

I, i = Input

O, o = Output.

3.5 LETTER SYMBOLS FOR TEMPERATURE

Amb = Ambient

Case = Case

J, j = Junction

stg = Storage

R_{th} = Thermal Resistance

op = Operating.

3.6 OTHER SYMBOLS

t = Time

f = Frequency

B = Bandwidth

d = Distortion

F = Noise figure

G = Gain

T = Temperature.

3.7 STANDARD VALUES

The standard values for 'E' ranges are shown in Appendix 'A'.

When an 'E' range is specified for a Range of Components in a Detail Specification, all values within the indicated range are available, within the limits specified.

The tolerance on values within each individual 'E' range will be as shown in Appendix 'A', unless otherwise stated in the Detail Specification.

4 **ANCILLARY BASIC SPECIFICATIONS**

The following supplementary specifications have been issued:

ESCC 2133000	Terms, Definitions, Abbreviations, Symbols and Units for Capacitors.
ESCC 2133400	Terms, Definitions, Abbreviations, Symbols and Units for Electrical Connectors.
ESCC 2133600	Terms, Definitions, Abbreviations, Symbols and Units for Electromagnetic Relays.
ESCC 2134000	Terms, Definitions, Abbreviations, Symbols and Units for Resistors.
ESCC 2135000 (1)	Terms, Definitions, Abbreviations, Symbols and Units for Discrete Non-Microwave Semiconductor Devices.
ESCC 2139000	Terms, Definitions, Abbreviations, Symbols and Units for Integrated Circuits.
ESCC 2139020	Terms, Definitions, Abbreviations, Symbols and Units for Charge Coupled Devices.

NOTES

1. For Discrete Microwave Semiconductor Devices (ESCC Generic No. [5010](#)), no individual ancillary specification for Terms, exists. ESCC [2135000](#) should be used to the extent applicable.

APPENDIX 'A'
STANDARD VALUES LIST

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%
100	100	100	100	100	100
				101	101
				102	102
			104	104	
			105	105	
			106	106	
		107	107		
		109	109		
		110	110		
		110	110		
		111	111		
		113	113		
	114	114			
	115	115			
	117	117			
	118	118			
	120	120			
	120	120			
	120	120			
	121	121			
	121	121			
	123	123			
	124	124			
	126	126			
127	127				
127	127				
129	129				
130	130				
130	130				
132	132				
133	133				
133	133				
135	135				
137	137				
137	137				
138	138				
140	140				
140	140				
142	142				
143	143				
145	145				
147	147				
147	147				
149	149				
150	150				
150	150				
150	150				
152	152				
154	154				
154	154				
156	156				
158	158				
158	158				
160	160				
162	162				
162	162				
164	164				
165	165				
167	167				
169	169				
169	169				
172	172				
174	174				
174	174				
176	176				
178	178				
178	178				
180	180				
180	180				
182	182				
184	184				
187	187				
187	187				
189	189				
191	191				
191	191				
193	193				
196	196				
196	196				
198	198				
200	200				
200	200				
203	203				
205	205				
205	205				
208	208				
210	210				
210	210				
213	213				
215	215				
215	215				
218	218				

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%
220	220	220	226	221	221
				222	222
				223	223
				226	226
				226	226
				229	229
			232	232	
			232	232	
			234	234	
			237	237	
			237	237	
			237	237	
		240	240		
		240	240		
		243	243		
		243	243		
		246	246		
		249	249		
		249	249		
		252	252		
		255	255		
		255	255		
		258	258		
		261	261		
	261	261			
	264	264			
	267	267			
	267	267			
	271	271			
	274	274			
	274	274			
	274	274			
	277	277			
	280	280			
	280	280			
	284	284			
	287	287			
	287	287			
	291	291			
	294	294			
	294	294			
	298	298			
300	300				
301	301				
301	301				
301	301				
305	305				
309	309				
309	309				
312	312				
316	316				
316	316				
316	316				
320	320				
324	324				
324	324				
328	328				
330	330				
330	330				
330	330				
332	332				
332	332				
336	336				
340	340				
340	340				
344	344				
348	348				
348	348				
352	352				
357	357				
357	357				
361	361				
365	365				
365	365				
370	370				
374	374				
374	374				
379	379				
383	383				
383	383				
388	388				
392	392				
392	392				
397	397				
402	402				
402	402				
407	407				
412	412				
412	412				
417	417				
422	422				
422	422				
427	427				
432	432				
432	432				
437	437				
442	442				
442	442				
448	448				
453	453				
453	453				
459	459				
464	464				
464	464				
470	470				
470	470				
475	475				
475	475				
481	481				

E6 ±20%	E12 ±10%	E24 ±5.0%	E48 ±2.0%	E96 ±1.0%	E192 ±0.5%
680	680	680	487	487	487
				487	487
				493	493
				499	499
				499	499
				505	505
			510	510	
			511	511	
			511	511	
			517	517	
			523	523	
			523	523	
		530	530		
		536	536		
		536	536		
		542	542		
		549	549		
		549	549		
		556	556		
		560	560		
		560	560		
		562	562		
		562	562		
		569	569		
	576	576			
	576	576			
	583	583			
	590	590			
	590	590			
	597	597			
	604	604			
	604	604			
	612	612			
	619	619			
	619	619			
	626	626			
	634	634			
	634	634			
	642	642			
	649	649			
	649	649			
	657	657			
	665	665			
	665	665			
	673	673			
	681	681			
	681	681			
	690	690			
698	698				
698	698				
706	706				
715	715				
715	715				
715	715				
723	723				
732	732				
732	732				
741	741				
750	750				
750	750				
750	750				
750	750				
759	759				
768	768				
768	768				
777	777				
787	787				
787	787				
787	787				
796	796				
806	806				
806	806				
816	816				
820	820				
820	820				
825	825				
825	825				
825	825				
835	835				
845	845				
845	845				
856	856				
866	866				
866	866				
876	876				
887	887				
887	887				
898	898				
909	909				
909	909				
909	909				
920	920				
931	931				
931	931				
942	942				
953	953				
953	953				
953	953				
965	965				
976	976				
976	976				
988	988				