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Edition 1.0 2017-07

IECQ ASSESSMENT SPECIFICATION

IEC Quality Assessment System for Electronic Components (IECQ System)

**Protection of electronic devices from electrostatic phenomena
– General requirements**





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FOREWORD

The IEC Quality Assessment System for Electronic Components (IECQ) is composed of those member countries of the International Electrotechnical Commission (IEC) who wish to take part in a harmonized system for electronic components of assessment quality. IECQ is also formally known in some European member countries as IECQ-CECC.

The object of the System is to facilitate international trade via business-to-business supply chain management tools and the harmonization of the specifications and quality assessment procedures for electronic components, assemblies and related materials and processes, and by the grant of an international recognized Certification of Conformity and the optional use of an IECQ Mark of Conformity. The components produced or services provided under the System are therefore accepted in all member countries without further testing.

This Assessment Specification is based upon the requirements of IECQ 03 Series of Rules of Procedure by:

Reliability Center for Electronic Components of Japan (RCJ)

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and published under the authority of:

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AMENDMENT RECORD

No previous editions.

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Protection of electronic devices from electrostatic phenomena -
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RCJS-5-1 (Ed.3) : 2016

Protection of Electronic Devices from Electrostatic Phenomena - General Requirements

Introduction

The first edition of this document is a RCJ(Reliability Center for Electronic Components of Japan)-5-1 standard that was edited based on TR C 0027-1: 2002 which is the Japanese translated document of IEC 61340-5-1 (Technical Report Type 2): 1998, and technical content has been changed by reference to the latest information. This third edition incorporates and reinforces the contents useful in the IEC 61340 series standards revised after the issue of the second edition without changing the basic contents. The item with J attached to its number and the annotation with J are added in this standard, not containing in the original standard.

Any contact and physical separation of materials or flow of solids, liquids, or particle-laden gases can generate electrostatic charges. Common sources of ESD include charged: personnel, conductors, common polymeric materials, and processing equipment. ESD damage can occur when:

- a charged person or object comes into contact with an ESD sensitive device;
- an ESD sensitive device comes into direct contact with a highly conductive surface while exposed to an electrostatic field;
- a charged ESD sensitive device comes into contact with another conductive surface which is at a different electrical potential. This surface may or may not be grounded.

Examples of ESDS (ESD sensitive devices) are microcircuits, discrete semiconductors, thick and thin film resistors, hybrid devices, printed circuit boards and piezoelectric crystals. It is possible to determine device and item susceptibility by exposing the device to simulated ESD events. The ESD withstand voltage determined by sensitivity tests using simulated ESD events does not necessarily represent the ability of the device to withstand ESD from real sources at that voltage level. However, the levels of sensitivity are used to establish a baseline of susceptibility data for comparison of devices with equivalent part numbers from different manufacturers. Three different models have been used for qualification of electronic components

- human body model (HBM),
- machine model (MM), and
- charged device model (CDM).

In current practice, devices are qualified only using HBM and CDM susceptibility tests.

RCJS-5-1 covers the ESD control program requirements necessary for setting up a program to handle ESDS, based on the historical experience of both military and commercial organizations. The fundamental ESD control principles that form the basis of this standard are as follows.

- Avoid a discharge from any charged, conductive object (personnel and especially automated handling equipment) into the ESDS.

This can be accomplished by bonding or electrically connecting all conductors in the environment, including personnel, to a known ground or contrived ground (as on board ship or on aircraft). This attachment creates an equipotential balance between all conducting objects and personnel. Electrostatic protection can be

maintained at a potential different from a “zero” voltage ground potential as long as all conductive objects in the system are at the same potential.

- Avoid a discharge from any charged ESD sensitive device.

Charging can result from direct contact and separation or it can be induced by an electric field. Necessary insulators (i.e. process-required insulators) in the environment cannot lose their electrostatic charge by attachment to ground. Ionization systems provide neutralization of charges on these necessary insulators (circuit board materials and some device packages are examples of necessary insulators). The ESD hazard created by electrostatic charges on the necessary insulators in the work place is assessed to ensure that appropriate actions are implemented, according to the risk.

- Once outside of an electrostatic discharge protected area (hereinafter referred to as an EPA) it is generally not possible to control the above items, therefore, ESD protective packaging may be required.

ESD protection can be achieved by enclosing ESD sensitive products in static protective materials, although the type of material depends on the situation and destination. Inside an EPA, static dissipative materials may provide adequate protection. Outside an EPA, static discharge shielding materials are recommended. Whilst all of these materials are not discussed in this standard, it is important to recognize the differences in their application.

Each company has different processes, and so will require a different blend of ESD prevention measures for an optimum ESD control program. Measures should be selected, based on technical necessity and carefully documented in an ESD control program plan, so that all concerned can be sure of the program requirements.

Training is an essential part of an ESD control program in order to ensure that the personnel involved understand the equipment and procedures they are to use in order to be in compliance with the ESD control program plan. Training is also essential in raising awareness and understanding of ESD issues. Without training, personnel are often a major source of ESD risk. With training, they become an effective first line of defense against ESD damage.

Regular compliance verification checks and tests (periodic audits) are essential to ensure that equipment remains effective and that the ESD control program is correctly implemented in compliance with the ESD control program plan.

RCJS-5-1 (Ed.3) : 2016

Protection of Electronic Devices from Electrostatic Phenomena - General Requirements

1 Scope

RCJS-5-1 specifies the general requirements for the protection of electrostatic discharge sensitive devices (ESDS) (see 3.2) from electrostatic discharges and fields. It applies to the manufacture and use of electronic devices. This standard does not apply to electrically initiated explosive devices, flammable liquids, gases and powders.

This standard provides the administrative and technical requirements for establishing, implementing and maintaining an ESD control program which specifies how to design, use and control a protected area to ensure that electrostatic sensitive devices, having a withstand threshold voltage of 100 V (human body model) or higher, can be handled with a minimum risk of damage resulting from electrostatic phenomena.

Normal precautions given in this standard are applicable for areas with clean room types in excess of ISO 14644-1 class 5. Alternative precautions may be required in clean rooms of ISO 14644-1 class 5 or less if contamination is formed as a result of using the procedures specified in this standard.

Although this standard does not include requirements for personnel safety, attention is drawn to the need for all concerned to comply with relevant local statutory requirements regarding the health and safety of all persons in all places of work, including those covered by this standard. Generally, there is no minimum value of resistance for the protection of ESDS. However, a minimum resistance value may be required for the safety of personnel and is specified in this standard. See the relevant requirements and/or publications IEC 61010-1, IEC 60479, IEC 60536, IEC 60364.

Note: The degree of the identification to the corresponding international standard.

IEC 61340-5-1 Ed.2 :2016 , Protection of Electronic Devices from Electrostatic Phenomena - General Requirements (MOD)

Where, MOD indicates "modify" according to ISO/IEC guide 21-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

JIS C 1010-1:1998 *Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirement* NOTE IEC 61010-1:1990 (IDT)

JIS C 60364, *Electrical installations of buildings* NOTE IEC 60364 (all parts)

JIS C 61340-2-1:2006, *Electrostatics – Part 2-1: Measurement methods – Ability of materials and products to dissipate static electric charge* NOTE IEC 61340-2-1:2002

JIS C 2170:2004, *Electrostatics – Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge accumulation* NOTE IEC 61340-2-3:2000 (IDT)

JIS C 61340-4-1:2008, *Electrostatics – Part 4-1: Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors* NOTE IEC 61340-4-1:2003 (IDT)

- JIS C 61340-4-3:2009, *Electrostatics – Part 4-3: Standard test methods for specific applications – Footwear*
NOTE IEC 61340-4-3:2001 (IDT)
- JIS C 61340-4-5:2007, *Electrostatics – Part 4-5: Standard test methods for specific applications – Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person*
NOTE IEC 61340-4-5:2007 (IDT)
- JIS C 61340-4-6:2016, *Electrostatics – Part 4-6: Standard test methods for specific applications – Wrist straps* NOTE IEC 61340-4-6:2010 (IDT)
- JIS C 61340-4-7:2011, *Electrostatics – Part 4-7: Standard test methods for specific applications – Ionization*
NOTE IEC 61340-4-7:2010 (MOD)
- JIS C 61340-4-8:2014, *Electrostatics – Part 4-8: Standard test methods for specific applications – Discharge shielding – Bags* NOTE IEC 61340-4-8:2010 (MOD)
- IEC 61340-4-9:2010, *Electrostatics – Part 4-9: Standard test methods for specific applications – Garments*
RCJS-TR-5-2:2015, *Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide* NOTE IEC 61340-5-2:2007 (MOD)
- IEC 61340-5-3:2015, *Electrostatics – Part 5-3: Protection of electronic devices from electrostatic phenomena – Properties and requirements classification for packaging intended for electrostatic discharge sensitive devices*
- ISO 14644-1:1999, *Cleanrooms and associated controlled environment - Part 1: Classification of air cleanliness*
- IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*
- IEC 60417:1973, *Graphical symbols for use on equipment - Index, survey and compilation of the single sheets*
- IEC 60479-1:1994, *Effects of current on human beings and livestock - Part 1: General aspects*
- IEC 60479-2:1987, *Effects of current on human beings and livestock - Part 2: Special aspects*
- IEC 60536:1976, *Classification of electrical and electronic equipment with regard to protection against electric shock*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

electrostatic discharge (ESD)

transfer of charge between bodies at different electrostatic potentials caused by direct contact or induced by electrostatic field

3.2

electrostatic discharge sensitive devices (ESDS)

discrete device, integrated circuit or assembly that may be damaged by electrostatic fields or electrostatic discharge encountered in routine handling, testing or transit