



TECHNICAL REPORT	GEIA-STD-0003	
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Long Term Storage of Electronic Devices		

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TechAmerica Standard

Long Term Storage of Electronic Devices

GEIA-STD-0003

January 2006

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(Formulated under the cognizance of the TechAmerica G-12 Solid State Devices Committee.)

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FOREWORD

Some electronic device users have the need to store electronic devices for long periods of time. Lifetime buys are commonly made to support production runs of assemblies that well exceed the production timeframe of its individual parts. This puts the user in a situation requiring careful and adequate storage of such parts to maintain the as-received solderability and minimize any degradation effects to the part over time. Major degradation concerns are Moisture, Electrostatic Fields, Ultra-Violet Light, Large variations in temperature, Air-Borne Contaminants, and outgassing.

Warranties and sparing also present a challenge for the user or repair agency as some systems have been designated to be used for long periods of time, in some cases for up to 40 years or more. Some of the devices needed for repair of these systems will not be available from the original supplier for the lifetime of the system or the spare assembly may be built with the original production run but then require long term storage This document was developed to provide a standard for storing electronic devices for long periods of time. For storage of devices that are moisture sensitive but that do not need to be stored for long periods of time, refer to JESD-033.

1 PURPOSE

This document is generated to provide an industry standard for Long Term Storage (LTS) of electronic devices by drawing from the best long term storage practices currently known. For the purposes of this document, LTS is defined as any device storage for more than 12 months but typically much longer. While intended to address the storage of unpackaged semiconductors and packaged electronic devices, nothing in this standard precludes the storage of other items under the storage levels defined herein.

1.1 Scope

1.1.1 Packaged Electronic Devices. Electronic Devices are defined as any packaged electrical, electronic, electro-mechanical (EEE) item, or assemblies using such items. This standard is intended to ensure that adequate reliability is achieved for devices in user applications after long term storage. Users are encouraged to request data from suppliers to this specification that demonstrates a successful storage life requested by the user. This standard is not intended to address built-in failure mechanisms that would take place regardless of storage conditions.

1.1.2 Unpackaged semiconductors. Unpackaged semiconductors are semiconductor wafer or dice.

1.2.3 User. The user of this long term storage standard may be any organization or entity who would store electronic devices or unpackaged semiconductors.

2 REFERENCE DOCUMENTS

MILITARY

MIL-PRF-27401 Propellant Pressurizing Agent, Nitrogen
MIL-PRF-81705 Barrier Materials, Flexible, Electrostatic Protective, Heat-Sealable

INDUSTRY

Electronic Industries Alliance, JEDEC Solid State Technology Association
JESD 625 Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices
JESD-033 Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

3 REQUIREMENTS

3.1 Storage Conditions

When this Standard is invoked, it is intended that specific storage level(s) per [Section 3.3](#) be specified. When invoked without specifying a level, Level 2 shall apply. When Level 2 is specified, it may be satisfied either with a portable storage container per [Section 3.2.1](#) or a fixed storage location per [Section 3.2.2](#). Level 4 may be used to meet Level 3 requirements. Level 3 may be used to meet Level 1 and/or Level 2 requirements.

3.2 Storage Containers

3.2.1 Type A (portable). Type A containment is portable in nature and uses a moisture barrier bag in accordance with [Section 3.4.1](#).

3.2.2 Type B (fixed location). Type B containment uses a cabinet, sealed shelves, or other fixed storage areas.

3.3 Levels

3.3.1 Level 1. Level 1 storage shall use a desiccant per [Section 3.4.2](#).

3.3.2 Level 2. Level 2 storage shall use dry nitrogen per [Section 3.4.4](#).

3.3.3 Level 3. Level 3 storage shall use both desiccant per [Section 3.4.2](#) and dry nitrogen per [Section 3.4.4](#).

3.3.4 Level 4. Level 4 storage shall consist of a Level 3 environment in a type A container (i.e., bag) which is then itself stored in dry nitrogen per [Section 3.4.4](#).

3.4 Storage Elements

3.4.1 Moisture Barrier Bag (MBB). The moisture barrier bag shall be in accordance with MIL-PRF-81705, TYPE I.

3.4.2 Desiccant. The desiccant material shall be capable of removing sources of corrosion and deterioration of product caused by oxidation, sulfurization, and other processes. The required levels of control are as follows:

- Oxygen: <0.1%
- Hydrogen sulfide: < 1 ppm
- Sulfur dioxide: < 1 ppm
- Hydrogen chloride: < 1 ppm
- Ammonia: < 1 ppm

The desiccant shall be packaged in moisture permeable bags or pouches(see [Table 1](#)). The amount of desiccant used per moisture barrier bag and unsealed exposure time shall be in accordance with the manufacturer's recommendations.

Table 1. Example Packet size vs. Storage Bag (Reference only)

Packet Size (mm)	Storage Bag Capacity (cc)
35 X 120	300
51 X 120	500
100 X 130	2,000

In the absence of manufacturer's recommendations, the amount of desiccant may be calculated based on the bag surface area and water vapor transmission rate (WVTR) in order to maintain an interior relative humidity in the MBB of less than 10% at 25°C.

For comparison between various desiccant types, military specifications adopted the “UNIT” as the basic unit of measure for desiccant material. A UNIT of desiccant is defined as the amount that will absorb a minimum of 2.85 g of water vapor at 20% RH and 25°C.

To meet the dry pack requirements of this Standard, the amount of water vapor that a UNIT of desiccant can absorb at 10% RH and 25°C must be determined, if it is not already known.

When the desiccant capacity at 10% RH and 25°C is known, the following equation should be used to determine the amount of desiccant needed.

$$U = (0.304 * M * WVTR * A)/D$$

where:

U = Amount of desiccant in UNITS

M = Shelf life desired in months

WVTR = Water vapor transmission rate in grams per 100 square inches in 24 hrs

A = Total surface area of the MBB in square inches

D = The amount of water in grams, that a UNIT of desiccant will absorb at 10% RH and 25°C

When the desiccant capacity at 10% RH and 25°C is not known, the quantity needed can be estimated using the following simplified equation.

$$U = 5 \times 10^{-3} A$$

where:

U = Amount of desiccant in UNITS

A = Total surface area of the MBB in square inches

3.4.3 For Moisture Sensitive Devices. Dry Cabinet at 5% RH or less. Storage in these dry cabinets may be considered equivalent to storage in a MBB with unlimited shelf life.

3.4.4 Dry nitrogen atmosphere. N₂ environments shall be in accordance with MIL-PRF-27401, Type 1 Gas, Grade C (99.995%). Note: other sources of dry nitrogen are not sufficiently contaminant free to provide reliable storage.

3.5 Long Term Storage Control

3.5.1 General. If any packaged electronic device (part) or unpackaged semiconductor is removed from storage (exposed), it shall be handled in accordance with the manufacturer's recommendations for ESD and (if moisture sensitive) moisture control. Unless otherwise allowed by the device's storage temperature, the temperature shall be maintained at 25°C + 10°C. Unpackaged semiconductors shall not be removed from their sealed packaging unless the facility has cleanliness environmental controls and properly documented processes to assure that, when exposed, the unpackaged semiconductors will not be degraded due to contamination. Unpackaged semiconductors shall be kept in the original sealed packaging to the maximum extent practical.

3.5.2 Initial Inspection - Optional. Visual Inspection for handling damage, contamination, or any other obvious damage. Exposed items to be handled/controlled per [Section 3.5.1](#).

3.5.3 Storage and labeling. Re-package (if type A container) or store (if type B container) all devices in accordance with the specified storage environment, container, and level. Exterior shall