

REVISIONS			
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION GODDARD SPACE FLIGHT CENTER GREENBELT, MD 20771 CAGE CODE: 25306			

REVISIONS (continued)			
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION GODDARD SPACE FLIGHT CENTER GREENBELT, MD 20771 CAGE CODE: 25306			

1.0 SCOPE

1.1 Scope. This specification establishes requirements for the preservation, packaging, packing and container marking for various types of small electronic parts and assemblies. These items are referred to herein as parts. Parts may be susceptible to damage from Electrostatic Discharge (ESD). Packaging and handling areas shall have appropriate electrostatic discharge controls in place to protect electronic parts which are susceptible to damage from ESD. This document assumes that proper ESD precautions and handling procedures (ESD safe gloves, finger cots, ionizers, vacuum tools, tweezers, etc.) are already in place, and does not address them here.

2.0 APPLICABLE DOCUMENTS

2.1 Government specifications, standards, and handbooks. The following Government specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, in effect on the date of the contract or purchase order.

STANDARDS

MIL-STD-3010	Test Procedures for Packaging Materials and Containers
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2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS in effect on the date of the contract or purchase order. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents in effect on the date of the contract or purchase order.

Electrostatic Discharge Association (EOS/ESD)

ESD S11.11	Surface Resistance Measurement of Static Dissipative Planar Materials
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American Society for Testing Materials (ASTM)

ASTM D257	Standard Test Methods for DC Resistance or Conductance of Insulating Materials
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3.0 REQUIREMENTS

3.1 General

3.1.1 Procurement Documentation. In addition to the requirements contained herein, packaging shall conform to specific requirements contained within the procurement documentation (part specifications, purchase order statement of work, etc.) when those requirements are more specific than the requirements contained herein. Special packaging requirements shall be noted on the initial Purchase Requisition (PR) to ensure flow down to the vendors.

3.1.2 Processes. All packaging and related activities including cleaning, preservation, packaging and packing shall be conducted in a manner to ensure that there is no degradation or physical damage to the part.

3.1.3 Cleaning. Parts shall be clean prior to packaging. When cleaning is required it shall be accomplished by a process or combination of processes, which will remove contaminants without causing degradation or damage to the part. The need for cleaning of any EEE parts shall be referred to the GSFC Code 562 Parts Group, for specific direction on processes, procedures, and approved facilities.

3.1.4 Hardware. Hardware accompanying a part (brackets, screws, etc.) shall be protected and enclosed within the unit package in a manner that will not damage the part or package. When practical, the hardware shall be mounted on the part. The package design shall prevent part damage from contact with other parts contained in the same package.

3.1.5 Packaging Materials. All packaging materials shall be clean, dry and chemically inert and shall maintain their required properties throughout normal storage, handling and usage.

3.1.5.1 Prohibited Materials. Packaging materials that may contaminate, damage or degrade parts by chemical degradation, outgassing, particle shedding, or diffusion during long term storage shall not be used in unit packages. Materials prohibited in unit packages include:

- (a) Carbon loaded plastic film or polyurethane foam.
- (b) Materials which contain amines, amides, or n-octanoic acid or its precursor.
- (c) Polyvinylchloride (PVC) plastics.
- (d) Surfactant added plastic bags or film materials commonly known as pink poly.

3.1.5.2 Corrosivity. Packaging materials in contact with parts shall not cause or contribute to corrosion or contamination of the part when stored for extended periods of time under high humidity conditions (Reference: MIL-STD-3010, Test Method 3005). When packaging materials are used which could potentially cause or contribute to corrosion they shall be physically separated from the part by the packaging design or the use of a suitable interleaving materials.

3.1.5.3 Plastic Bags and Film. When plastic film or bags are used as part of the unit package they shall be of the laminated, static shielding type which incorporates a conductive layer as one of the laminations.

3.2 Unit Package Design.

3.2.1 Quantity. The quantity of parts contained in each unit package shall be one (1), except as provided in the following paragraphs.

3.2.1.1 Pairs, Sets, and Kits. Parts furnished in pairs, sets, or kits under one part identification number shall be unit packaged as one pair, one set, or one kit, as applicable. The package design shall prevent part damage from contact with other parts contained in the same package. Specific non-standard packaging instructions shall be noted on the kit requests.

3.2.1.2 Chip Devices. Chip devices may be packaged as described in paragraph 3.3.5 (Figure 5). Chip devices provided as matched sets shall have no more than one set contained within each unit package.

3.2.1.3 Strip Packages. Unit packages as described in paragraph 3.3.1 and 3.3.6 may be provided in strips with a breakaway or cut away capability that permits issue and control of individual parts.

3.2.2 Physical Protection. The unit package design for parts with leads shall provide the leads with protection from physical damage by whatever means necessary. Leads shall be maintained in their manufactured configuration without causing undue loads or stresses capable of causing damage to the part. Securing leads by tape or adhesive is not permitted. Special packaging requirements shall be specified on the PR.

3.2.2.1 Manufacturer Packaging. To the greatest extent possible, packaging materials should reflect the manufacturer's specially designed packs. They provide the greatest security in handling of the parts without damage to the terminations (leads, balls, columns).

3.2.3 Removal and Replacement Capability. The unit package shall be easy to open and reclose for reuse. It shall be constructed in such a manner that the part can be easily removed and replaced without damage to the part or to the integrity of the package.

3.2.4 Static Dissipative Materials. Containers and packaging materials used for and within the unit package shall be conductive or static dissipative with a surface resistivity not greater than 1×10^{12} ohms/square in accordance with ASTM D257 or ESD S11.11 and a static decay time of less than 2 seconds in accordance with MIL-STD-3010, Test Method 4046.

3.2.5 Documentation. Documentation provided with parts shall be packaged separately from the parts; preferably in a separate unit package.

3.3 Unit Package Selection. The following paragraphs and the figures, which are used for illustration provide a number of examples of unit packages which can be used to meet the requirements of this specification. The packaging selected shall meet the applicable requirements of paragraphs 3.1 and 3.2 of this specification.

3.3.1 Tube or Vial. The unit package is a tube or vial into which the part is placed with cushioning inserts to secure and protect the part. This package is illustrated in Figure 1.

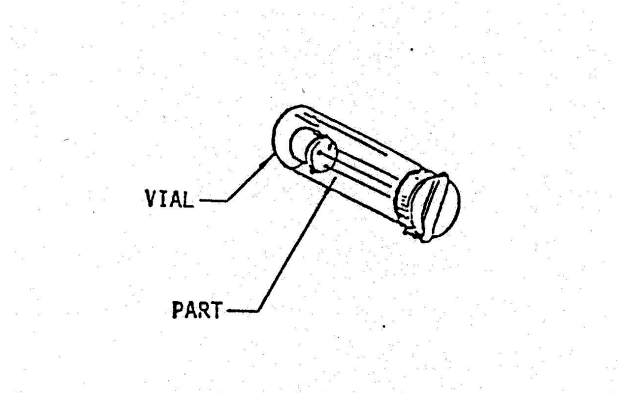


Figure 1. Vial/tube

3.3.2 Cushioned Plastic Box. The unit package is a rigid or semi-rigid plastic box with preformed cushioning inserts. No pink poly cushioning may be in contact with the protected device. Additional protection may be provided by a supplemental holding device. This package is illustrated in Figure 2. CAUTION- Parts with unsupported leads (e.g. lead frame has been removed or is not present) shall not be placed in this type of packaging, due to lead damage incurred during movement in shipping.

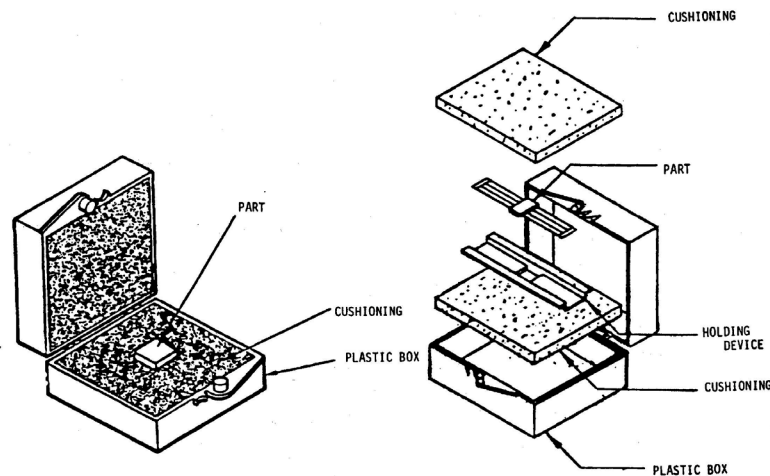


Figure 2. Cushioned Box

3.3.3 Chip Carrier (waffle pack). The unit package is a two-piece, plastic, dust proof carrier formed with individual cavities. No more than one part shall be placed into each cavity. A sheet of static dissipative film or Tyvek paper shall be placed over the cavities before closing the carrier. The closure shall be by friction locks, clips or similar means.

3.3.3.1 Sizing. This package is illustrated in Figure 3. Note that carrier trays are sized to safely hold specific sizes of chip components. Ensure waffle pack carrier trays are appropriately sized for the devices. Cavities which are too big can allow parts to move too much; cavities which are too small can crush the components when the lid is clipped down.

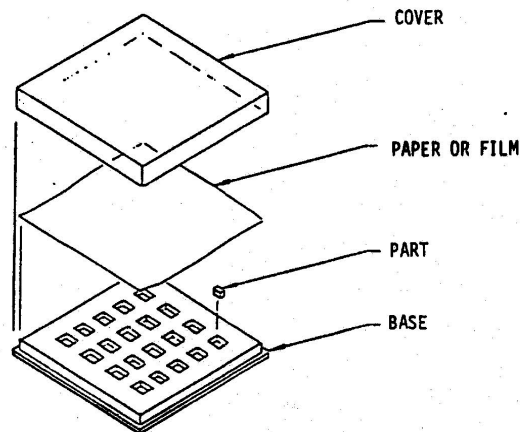


Figure 3. Chip Carrier (Waffle Pack)

3.3.4 Bag. The unit package shall be a bag conforming to paragraph 3.1.5.3. The part is placed into the bag which shall be closed by heat seal, zipper or otherwise designed to prevent accidental loss of part. Additional wrapping or other material may be used within the bag for additional protection to the part or the bag. This package is illustrated in Figure 4. CAUTION- This method shall be used only when the part is rugged enough to be adequately protected in this manner.

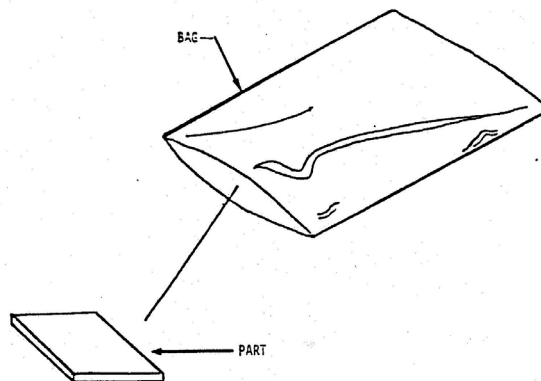


Figure 4. ESD Safe Bag

3.3.5 Gel Pack. The unit package is a plastic box with a gel coating on the inside bottom of the box. The part shall be placed on and adhere to the coated surface to maintain part position during handling and shipping. Parts are to be placed on and removed from the coated surface with tweezers or vacuum tool. The gel coating shall be such that it will securely hold the part and not cause contamination of the part. Level of tack shall be discussed with GSFC Code 562 Parts Group, if this style of packaging is required. This package should not be used where leads are formed and not in the plane of the package. This package is illustrated in Figure 5.

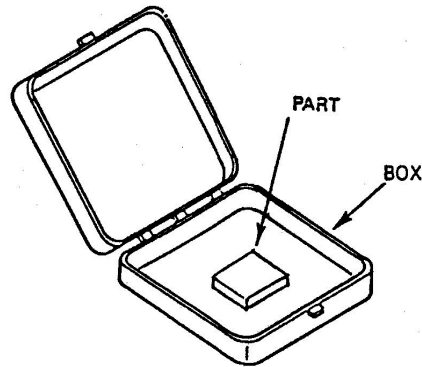


Figure 5. Gel Pack

3.3.6 Corstat™ Pedestal Tacki Pak. The unit package is an ESD conductive plastic box with a gel coating on the pedestal found on the bottom of the box, and a conductive foam pad on the lid. The part shall be placed on the pedestal (ensure pedestal is appropriately sized for device) and the lid closed, maintaining pressure on the device to maintain part and lead position during handling and shipping. Parts shall be placed on and removed from the “tacki” surface with a vacuum tool. The gel coating shall be such that it will securely hold the part and not cause contamination of the part. This package is illustrated in Figure 6.



Figure 6. Pedestal Tacki Pak

3.3.7 Corstat™ SM (Surface Mount) Compak Shipper. The unit package is an ESD static shielding shipper box with an ESD dissipative insert specifically designed to protect fine pitch formed leads. The ESD safe dissipative adhesive pad on the lid of the insert allows for the device to be picked up without touching. When placed on the carrier, a molded pedestal holds the part with leads suspended, eliminating any possible damage in shipping. 1, 4, and 10 count unit pack shipper boxes are available. See Figure 7.



Figure 7a. SM ComPak

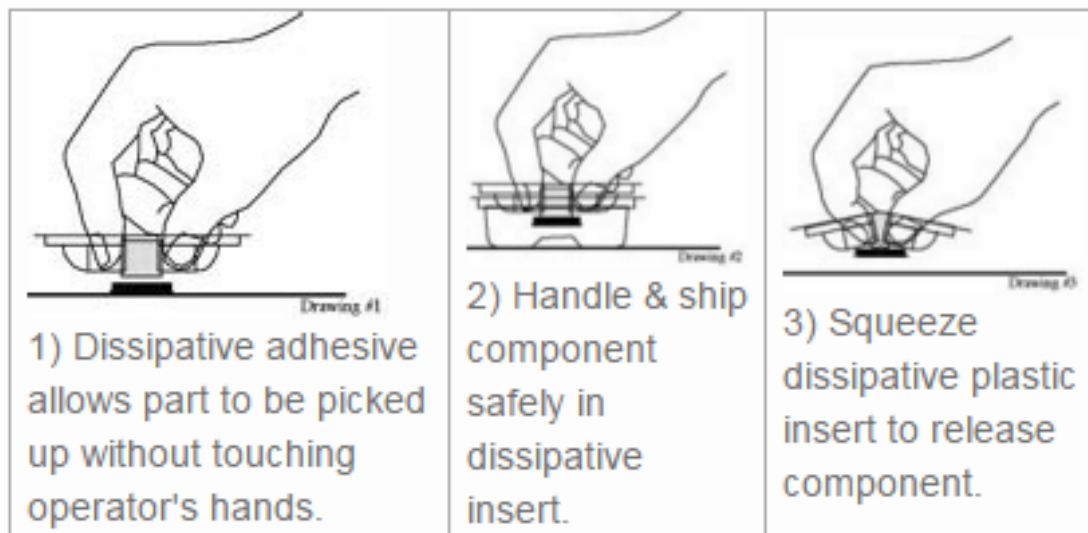


Figure 7b. SM ComPak Use Pictorial

3.3.8 Topline® CCGA Storage System. Topline offers a wide range of ESD safe, customizable packaging storage systems for CCGA packages up to 1752 columns. They are offered in single part options, as well as JEDEC 8, 10, and 12 cavity, along with a panel for up to 20 devices. The system provide a hinged box, with custom inserts (typically ESD safe FR4, version B) and trays matching your device size, and top side foam insert and ESD safe rubber bands to hold the hinged box closed. The CCGA package is aligned with the insert, and the columns drop through, floating in air. Note proper inserts, matching spacing, diameter, and length, must be used to prevent column damage. These dimensions vary from device to device and may require various inserts for the same base system. See figure 8.

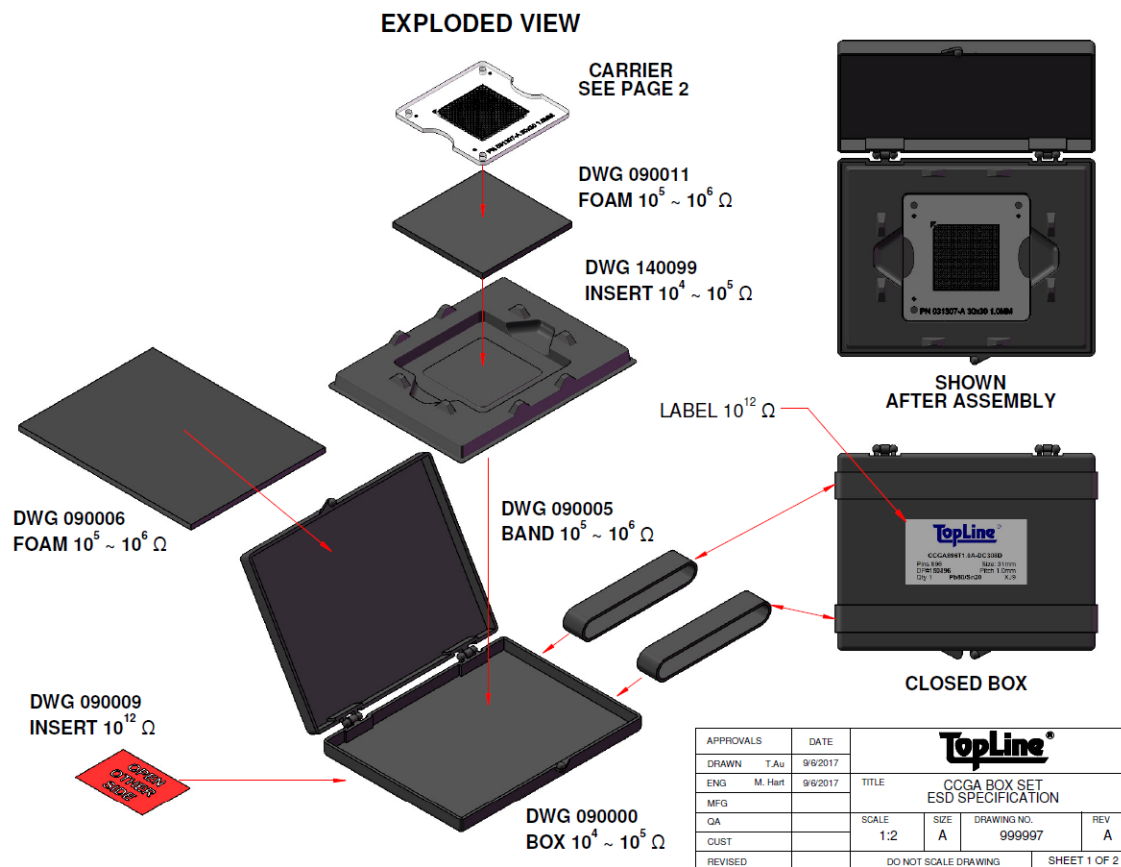


Figure 8a. Topline CCGA Packaging System

DWG	DESCRIPTION	MATERIAL	ESD TYPE	RESISTIVITY
CARRIER VERSION E	FRAME	POLYCARBONATE	STATIC DISSIPATIVE	$10^6 \sim 10^8 \Omega$
	HOLES	AIR	INSULATIVE	$10^{12} \Omega$
CARRIER VERSION B	FRAME	FR4	STATIC DISSIPATIVE	$10^6 \sim 10^8 \Omega$
	HOLES	AIR	INSULATIVE	$10^{12} \Omega$
CARRIER VERSION BR	FRAME	BRASS	CONDUCTIVE	$< 1 \Omega$
	HOLES	AIR	INSULATIVE	$10^{12} \Omega$
090011	SMALL FOAM	POLYURETHANE	CONDUCTIVE	$10^5 \sim 10^6 \Omega$
090006	LARGE FOAM	POLYURETHANE	CONDUCTIVE	$10^5 \sim 10^6 \Omega$
140099	INSERT	STYRENE	CONDUCTIVE	$10^4 \sim 10^5 \Omega$
090005	RUBBER BANDS	RUBBER	CONDUCTIVE	$10^5 \sim 10^6 \Omega$
090000	HINGED BOX	POLYPROPYLENE	CONDUCTIVE	$10^4 \sim 10^5 \Omega$
090009	SMALL LABEL	PAPER	INSULATIVE	$10^{12} \Omega$

			
TITLE CCGA BOX SET ESD SPECIFICATION			
SCALE 2:1	SIZE A	DRAWING NO. 999997	REV A
DO NOT SCALE DRAWING		SHEET 2 OF 2	

Figure 8b. ESD Properties for System Elements

3.3.9 Dual Inline Packages (DIP). Although not very common in new designs, DIP packages remain in use for legacy systems and engineering units. DIP packages should be shipped, transported, handled in DIP containers (sticks). Tubes should be properly sized for the terminal/lead spacing and should have appropriate stops/bumpers installed in both ends to prevent parts from being expelled from the packaging. Tubes may require re-sizing for length, to prevent small quantities of parts from banging into each other during shipment.

3.3.10 Dual Flatpacks. Dual flatpacks with unformed leads are generally not shipped with tie bars in place. Specialized carriers, from vendors such as RH Murphy (<https://www.rhmurphy.com>) and Sensata Technologies (<https://www.sensata.com>) provide a wide variety of sizes and lead counts. The RH Murphy design is a one-piece carrier which holds the devices securely; the Sensata Technologies 29 series, for example, is available in both a one piece and two-piece variant, depending on the package style and size. In the two-piece version, a clip snaps over the carrier device in place. A special removal tool is required to safely extract devices from the one-piece carriers. Once properly seated in the carrier, these parts may be placed in special tube carriers or sealed in ESD safe bags.

3.3.11 Formed Lead Packages. In addition to the packages shown in paragraphs 3.3.6 and 3.3.7, another option, able to handle multiple types of part, with different types of leads and leads forms, in a single package, is the Fancort Matrix Tray (<https://www.fancort.com>). These products, available in different configurations, and adjustable for different type of packages, protect sensitive formed leads by isolating the package leads in air. The system includes a complete two piece frame, with various movable inserts that slide on rails, and a cardboard shipping container with foam packaging. Capacity can be up to ten (10 devices), depending on the package type (quad or dual flatpack). Custom individual packages can also be obtained in higher quantities.



3.4 Part Handling tools. Electronic parts can be damaged through the use of improper handling equipment. Hard metal tweezers shall not be used for handling electronic parts, as they can scratch or crack package materials and finishes.

3.4.1. Gloves/Finger Cots. ESD dissipative gloves or finger cots shall be worn to prevent the transfer of dirt and oils to parts surfaces during the handling process.

3.4.2 Tweezers. Only metal tweezers with ESD safe coatings on the tips, or ESD safe plastic tweezers shall be used for transferring parts.

3.4.3 Vacuum Station. The preferred method for handling parts, especially very small parts, is a vacuum pickup system, such as the Zephyrtronics Airpick ZT-3-MIL vacuum handling station (Reference Figure 9). The vacuum handling station uses ESD safe tips, appropriately sized for the devices being transferred, fitted to a vacuum pencil.



Figure 9a. ZT-3-MIL Vacuum Handling Station



Figure 9b. ZT-3-MIL Vacuum Handling Station Tips

3.5 Intermediate Containers. The use of intermediate containers for parts packaged in unit containers as described herein, is optional except that they are required whenever different part numbers are consolidated for one shipment. Unit packages containing identical parts shall be uniformly loaded into a plastic bag, plastic box, or a paperboard or fiberboard folding or setup box. Voids shall be filled using a clean, non-dusting, and chemically neutral ESD safe cushioning material.

3.6 Shipping Containers. Unit and intermediate packages shall be overpacked in a suitable shipping container. The shipping container shall comply with the regulations for the mode of shipment used and shall provide for safe delivery to its destination at the lowest tariff cost. Fiberboard boxes used as shipping containers shall bear a boxmaker's certificate in accordance with the applicable freight classifications. The weight and size limits indicated in the box certificate shall not be exceeded.

3.7 Marking. All containers shall be legibly and durably labeled, tagged, or marked to show the information specified in the following paragraphs. It is not necessary to duplicate marking on the unit package when it is clearly visible on the part without opening the package.

3.7.1 Unit Packages. Unit packages shall show the following information:

- (a) Part Identification Number
- (b) Manufacturer's Name, Initials, or Trademark
- (c) Serial Number
- (d) Lot Number or Date Code
- (e) ESD rating (if Level 0)
- (f) MSL Classification (if applicable)

3.7.2 Intermediate Containers. Intermediate containers (when used) shall show the following information:

- (a) Part Identification Number
- (b) Purchase Order or Contract Number
- (c) Nomenclature
- (d) Quantity of parts contained

3.7.3 Shipping Containers. Shipping containers shall show the following information:

- (a) Purchase Order or Contract Number
- (b) Manufacturer's or Supplier's Name
- (c) Shipping documentation (packing slips) shall indicate the quantity of each part number contained in the shipment if not included in the shipping container marking.

3.8 Workmanship. The packaging, packing, and marking shall be of uniform good quality and free from defects that will impair service life and appearance.

3.9 Special Packaging and Handling Guidelines. Most EEE parts are susceptible to damage due to improper packaging or handling, during opening or unpacking as well as kitting and other re-packaging activities. Some specific cautions, though not all inclusive, are provided in an attempt to prevent product loss.

3.9.1 Package Orientation. Many vendor packaging trays and containers are specifically designed for their products. They are often designed to hold the part safely in a specific orientation. Opening the package in an alternate orientation may allow parts, such as pedestal flat packages, to shift when the trays are separated, causing parts to slide and "sweep" the corner leads.

3.9.2 Die Products. Die products are often shipped in tacki-pak or tacki-tape carriers and require special vacuum tools to safely release them from their packaging. Die should not be handled with tweezers or any other mechanical implement. Some dice have microscopic surface features called air bridges, which can be crushed during handling with improper tools (even vacuum tools), rendering the die useless. Die products should not be handled unless specific knowledge of the construction and specific handling procedures are provided.

3.9.3 Pre-formed Leads. Parts received with the leads already formed and trimmed must be handling with care, as the planarity of the leads, as well as the leads themselves can easily be damaged during handling. Packages

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility. The entity handling the EEE parts is responsible for the inspections, as necessary, to ensure conformance to the requirements of this specification.

4.2 Method. Packages shall be visually examined to verify that the package, packaging materials, orientation of parts, container markings and workmanship are in conformance to the requirements of Section 3 of this specification.

5.0 PREPARATION FOR DELIVERY Not applicable

6.0 NOTES

6.1 Intended Use. This specification is intended for use for the safe packaging, storage, kitting, and transport of EEE parts. Some parts may require special packaging for protection from effects such as magnetic fields (e.g. MRAM), which are manufacturer specific. This document is not intended to provide an exhaustive listing of packaging methods and materials. Safe, proper part packaging shall not preclude appropriate ESD precautions and handling measures.

6.2 Inventory Repackaging. Repackaging of existing inventory, in accordance with the guidelines of this document is not required, unless the inventory is removed for kitting or inventory purposes and found to be non-compliant.

6.3 Notice. When GSFC drawings, specification, or other data are used for any purpose other than in connection with a definitely related GSFC procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; the fact that GSFC might have formulated, furnished, or in any way supplied the said drawings, specification, or other data is not to be regarded by implication or otherwise in any manner licensing the holder or any person or corporation, or conveying any right or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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Appendix A: Moisture Sensitive Parts Control Plan

Moisture sensitive devices (MSD) are any electrical/electronic device, including semiconductors, microcircuits, and hybrids, encapsulated with epoxy molding compounds. MSD's usually contain other organic materials inside the package such as die attach adhesives and epoxy-glass or ceramic substrates. The plastic molding compounds used for MSD encapsulation are hygroscopic and absorb moisture dependent on time and the storage environment. Absorbed moisture will vaporize during the rapid heating of the solder reflow process, generating pressure at various interfaces in the package, which is followed by swelling, delamination and, in some cases, cracking of the plastic. These defects can pass undetected through typical inspection and test processes, while resulting in latent device degradation and failures.

Manufacturers classify and label the Moisture Sensitivity Level (MSL) of their MSD products, in accordance with IPC JEDEC J-STD-020. IPC JEDEC J-STD-033 describes the proper handling and packaging of MSD, as well as the specifications for packaging materials.

Equipment Required:

- Moisture Barrier Bags (MBB)- e.g. Desco 138xx (xx indicates size code). There is also a higher grade MBB, which is also EMI/RFI shielding and slightly better moisture protection, Desco 139xx.
- Desiccant- Molecular Sieve with Tyvek preferred- e.g. Sorbent Systems 41MS37 (1 oz)
- Humidity Indicator Cards (HIC) (5%, 10%, 60%)- Desco 13869 (JEDEC Compliant)
- MSL Labels- e.g. Desco 06736 (IPC JEDEC J-STD-020 compliant)
- Vacuum Sealer w/ Dry Air/Dry Nitrogen Purge- e.g. AmerivacS CAVN-20
- Drybox (optional)- e.g. Manncorp Ultra Dry 1490V (no GN2 required)

Incoming Review:

Review MSL marking on paperwork, box, or internal MBB package. Upon receipt, shipments should be inspected for bag integrity and HIC indication of moisture intrusion (pink color on any dots). There should be no holes, gouges, tears, or punctures of any kind that expose either the contents or an inner layer of the bag. The label should be reviewed for conformance to the purchase order, but the bag should not be opened until the contents are ready to be used (either inspected or kitted). J-STD-020 details allowable exposure times once the devices are removed from the bag or exposed to the ambient conditions.

Incoming Inspection:

XRF required:

1. Open MBB to remove parts for XRF (if required)
 - a. To open a moisture barrier bag when the contents are ready to be used or inspected, simply cut across the top of the bag as close to the seal as possible, being careful not to damage the enclosed materials. By cutting close to the seal, you will allow as much room as possible for resealing. Once the bag has been opened, please follow the guidelines for ambient exposure time to ensure that the devices are maintained below the critical moisture level.

- b. Verify package moisture condition via HIC. No spots should show pink if seal is good and conditions have been within J-STD-033 limits.
 - i. If 5% spot is Pink, and 10% is blue, replace desiccant and continue.
 - ii. If 10% dot is not blue (and 5% spot is pink), parts will require bake.
2. Store opened MBB in drybox or re-seal as soon as practical with HIC and desiccant. Maximum shelf life in a humid environment varies by MSL rating; intent is to re-seal the parts before shelf life is reached.
3. Perform XRF. Parts should not be exposed to room environment for more than TBD hours.
4. Return XRF parts to Moisture Barrier Bag; reseal with dry nitrogen purge. HIC may be re-used if not expired (e.g. 5% dot has not started to turn pink); desiccant should be replaced if it was stored open.
 - a. The seal area must not exhibit any separation when subject to load and temperature conditions specified in MIL-B-81705 and must be impermeable to moisture according to MIL-B-81705. A seal pressure to 60 psi–70 psi, and a seal time of 3-4 seconds at approximately 225 °C has been shown to provide a good seal. The integrity of the seal is vital to the storage life of the devices.
5. Put parts in storage (drybox or regular storage)

Kitting follows a similar process.

1. Open MBB to remove parts for kit
 - a. Once the bag has been opened, please follow the guidelines for ambient exposure time to ensure that the devices are maintained below the critical moisture level.
 - b. Verify package moisture condition via HIC. No spots should show pink.
 - i. If 5% spot is showing Pink, replace desiccant and continue.
 - ii. If 10% dot is showing pink, notify requester because parts require bake.
2. Copy information from the MSL warning label on the original package to the new MBB MSL warning label (kitted parts).
 - a. Be sure to record the new seal date on the Kit MBB label; do not record the original seal date.
3. Add parts, new HIC, and new desiccant packs appropriate for the package size to the kit MBB and seal.
4. Verify HIC in original package (if residual parts exist); re-use if not expired (e.g. 5% dot has not started to turn pink); desiccant should be replaced.
5. Re-seal MBB for residual parts.
 - a. The seal area must not exhibit any separation when subject to load and temperature conditions specified in MIL-B-81705 and must be impermeable to moisture according to MIL-B-81705. A seal pressure to 60 psi–70 psi, and a seal time of 3-4 seconds at approximately 225 °C has been shown to provide a good seal. The integrity of the seal is vital to the storage life of the devices.
6. Return parts to storage (drybox or regular storage)

Notes:

- No double bagging for MBB packing. The desiccant, HIC, and parts must all be in the bag together. Parts, as always, should be properly packaged in appropriate packaging to prevent damage.
- In a 60%RH environment, at +30°C, the 5% spot will begin to transition from blue to pink within 4 minutes and will reflect wet in 7 minutes. The 10% spot will begin to transition in 6 minutes and show wet in 10 minutes. HIC are resettable, by baking, unless the 60% spot has begun to transition. The HIC is no longer resettable once the 60% spot shows pink and must be thrown out. For practical purposes, replacing the HIC is much more expedient than trying to get them into a bake before they hit the 60% wet mark and reuse them.
- The following table describes the MSL floor life ratings from IPC JEDEC J-STD-020. For each MSL level, the floor life is the maximum time out of the “dry” conditions before the part requires a bake. Replacing the desiccant can help reset the floor life for a part exposed briefly during kitting. If the part remains out of the package beyond the floor life, or the HIC indicates unacceptable moisture levels in the package, the parts will require a bake.

Table 5-1 Moisture Classification Level and Floor Life

Moisture Sensitivity Level	Floor Life (out of bag) at factory ambient ≤30 °C/60% RH or as stated
1	Unlimited at ≤30 °C/85% RH
2	1 year
2a	4 weeks
3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	Mandatory bake before use. After bake, must be reflowed within the time limit specified on the label.

How much desiccant is required depends on the desired shelf life, Moisture Vapor Transfer Rate (MVTR) of MBB, surface area of MBB, maximum internal humidity (MIH) desired. The below table shows some examples of desiccant units (a desiccant unit ~ one ounce) required for approximately one year of shelf life. Don't forget the bag area includes both sides- a 10"x20" bag is 400 in² and would require 5-6 units to maintain a 20% MIH.

INTERIOR BAG SURFACE AREA	NUMBER OF DESICCANT UNITS		
	*MIH <20%	MIH <30%	MIH < 40%
100 sq. in.	1.5	1.0	1.0
130 sq. in.	2.0	1.5	1.0
160 sq. in.	2.0	1.5	1.5
200 sq. in.	2.5	2.0	1.5
240 sq. in.	3.0	2.0	1.5
290 sq. in.	4.0	2.5	2.0
340 sq. in.	4.5	3.0	2.5
390 sq. in.	5.0	3.5	2.5
450 sq. in.	5.5	4.0	3.0
510 sq. in.	6.5	4.5	3.5
580 sq. in.	7.5	5.0	4.0
650 sq. in.	8.0	5.5	4.0
720 sq. in.	9.0	6.0	4.5

Examples of packaging MBB with HIC and desiccant:

