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D	09/27/16	Par 3.1 Added DPA sample clarification Par 3.8 Clarified Par 4: added two sentences to end Updated Table 7, Title, and corresponding note 2. Update Par 4.3.2 Title & Table 8 Title & notes Table 10 note 4 updated Table 12, removed conditions for seal and note 4, deleted note 3 Table 13 and associated notes Table 14 Notes 1,4,5,& 10 Table 15 notes 4, 7 & section 4.8.1 moved Multi Chip Module to section 4.7.2 Table 14. Table 18 Notes 3 & 4	5-6 7 8 11 12 14 15 16 18 19 21
E	07/31/18	Update Tables 7 & 8.	12-13
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1.0 SCOPE

This document describes the Destructive Physical Analysis (DPA) testing requirements for EEE parts. DPA testing is performed at independent test facilities approved by SEAKR Engineering.

2.0 APPLICABLE DOCUMENTS

The latest revision is applicable, unless otherwise specified.

Military Standards

MIL-STD-202	Test Method Standard Electronic and Electrical Component parts
MIL-STD-750	Test Method Standard Semiconductor Devices
MIL-STD-883	Test Method Standard Microcircuits
MIL-STD-1580	Destructive Physical Analyses for Electronic, Electromagnetic and Electromechanical Parts

Others

EIA-469	Standard Test Method for Destructive Physical Analysis (DPA)
Ceramic	Monolithic Capacitors

2.1 ORDER OF PRECEDENCE

The following order of precedence shall be used:

- a.) Purchase Order Notes
- b.) This Document
- c.) Military Standards / MIL-STD-1580

In the event of a conflict between MIL-STD-1580 and the detailed part specification used to manufacture the part, parts shall be dispositioned for "Customer (SEAKR) Review".

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3.0 GENERAL REQUIREMENTS

3.1 SAMPLE SIZE

The standard sample size shall be 5 pieces unless it is determined by SEAKR and/or the customer that a reduced or increased sample size is required based on heritage, availability, cost, and SEAKR program lot size. Samples to be subjected to Residual Gas Analysis (RGA) testing shall also be drawn from the provided samples. When multiple tests are specified by the purchase order such as PIND or Xray and DPA, screened failures may be used for the DPA samples provided that they are clearly identified and traceable in the DPA report. This allows any possible anomalies to be addressed accordingly.

3.2 PHOTOGRAPHY

Photographic requirements of MIL-STD-1580 shall apply. At external visual inspection, care should be taken to ensure that all part markings are recorded prior to disassembly. All anomalous conditions shall be photo documented in detail to allow proper identification of the condition(s).

3.3 LABORATORY SUITABILITY

SEAKR Engineering shall approve DPA testing laboratories prior to testing.

3.4 DPA REPORT

At the completion of the DPA analysis, a complete report detailing the findings shall be generated. The report shall meet, at a minimum, the requirements of MIL-STD-1580 paragraph 4.2.2. The DPA report shall be provided on a CD-ROM, or be downloadable from the laboratories file transfer site, in PDF format.

3.4.1 Step Coverage Evaluation Of Metallization Layers

Metallization step coverage will not be cause for rejection. Due to the current semiconductor technology, the feature size on most integrated circuits is less than one micron and step coverage of less than 50% is typical. All lots with a worst case step coverage less than 20% will be evaluated by SEAKR and disposition will be based on current density calculations and/or the manufacturer's documented design rules.

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3.5 DPA RESIDUES

All devices shall be packaged and labeled with SEAKR part number, Manufacturer part number, Lot Date Code, Purchase Order Number and shall accompany the original report to SEAKR Engineering for final approval and retention.

3.6 VERIFICATION OF PROHIBITED MATERIALS

All devices shall be tested to verify the absence of Prohibited Materials. The analysis of external and internal materials shall be performed per MIL-STD-1580, Section 9 and the detailed requirements section for each part type.

Measurement test conditions and locations shall strictly follow the requirements specified in this document and in MIL-STD-1580 including, but not limited to, measuring on as flat a surface as possible, maintaining guard band areas, and following beam size & magnification requirements. For items containing cadmium and zinc, the prohibited materials analysis shall take into account the surface plating coverage requirements specified in the detailed part specification. Each measurement location relative to the overall configuration of the part shall be clearly documented in photos or diagrams.

3.7 RADIOGRAHIC INSPECTION

When radiographic inspection examination is performed using real time x-ray, the following shall be documented when a reject is encountered.

- A.) Equipment and Model used
- B.) Magnification (marker bar acceptable) and Power
- C.) Focal Spot, when available
- D.) When parts fail, the failing parameters shall be noted on photographs or in comments

3.8 DPA FAILURES / NON-CONFORMANCES

SEAKR shall be notified immediately (prior to shipment / report completion) when a non-conformance occurs during test.

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3.9 MILITARY SPECIFICATIONS CONFLICTS WITH MIL-STD-1580

When there are conflicts between this document, the detailed part specification, or MIL-STD-1580, the parts shall be disposition for customer review.

4.0 DPA TESTING REQUIREMENTS

DPA testing shall be performed in accordance with MIL-STD-1580 and the following requirements herein. If the part type is not defined in this document use the requirements from the latest version of MIL-STD-1580. The SEAKR Purchase Order may call out additional instructions/clarifications on inspection criteria. For example, an additional SEAKR document may be referenced to define a cross sectional area or area for plating thickness measurements (i.e., connector contact area).

4.1 CAPACITORS

4.1.1 Capacitors, Ceramic Chip

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 10.2 and Table 1 herein. This includes but it is not limited to the following styles of capacitors: CDR, CKS.

Table 1 – Capacitors, Ceramic Chip

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 10.2.1.1	5
Prohibited Materials Analysis	1580, para 10.2.1.2	1
Cross Section / Microscopic Exam	1580, para 10.2.1.4 & EIA-469	5
Dielectric Thickness Measurement	Note 1	3
SEM EDS Electrode Material	Note 1, Note 2	3

Notes:

- 1.) Testing is for information only.
- 2.) Testing is to determine if part uses Base Metal Electrode (BME) or Precious Metal Electrode (PME). Pure Silver (Ag) electrode metal is prohibited.

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4.1.2 Capacitors, Tantalum Chip

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 10.11 and 10.12, and Table 2 herein. This includes but is not limited to the following styles of capacitor: CWR.

Table 2 – Capacitors, Tantalum Chip

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 10.11.1.1 or 10.12.1.1 (as applicable)	5
X-ray	1580, para 10.11.1.2 or 10.12.3 (as applicable)	5
Prohibited Materials Analysis (Note 1)	1580, para 10.11.1.3	1
Cross Section / Microscopic Exam (Note 2)	1580, para 10.11.1.4	5

Notes:

- 1.) Measurements on the end caps of the device shall be taken on a flat surface.
- 2.) For tri-anode Tantalum capacitors (AVX series TBM and Kemet series T510), one device shall be cross sectioned at each anode. The acceptance criteria shall apply to all 3 cross sections for the anode. However, the cathode attach is acceptable when any of the 3 cross sections meet the criteria. (The 3 cathodes are pre-assembled and considered common).

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4.1.3 Capacitors, Ceramic Leaded and Ceramic Stacked Module

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 10.1 and 10.14, MIL-STD-202 and Table 3 herein. This includes but it is not limited to the following styles: CCR, CKS, CKR, and SMPS (Stacked).

Table 3 – Capacitors, Ceramic Leaded and Ceramic Stacked Module

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 10.1.1.1 or 10.14.1.1 (as applicable)	5
Prohibited Materials Analysis (Note 1)	1580, para 10.1.1.2	1
Terminal Strength	MIL-STD-202, Method 211, Cond A, C, or D (as applicable)	2
Decapsulation / Delid	1580, para 10.1.1.4 or 10.14.4 (as applicable)	2
High Temperature Solder Verification	(Note 1)	1
Encapsulation / Microscopic Exam	1580, para 10.1.1.6 or 10.14.4.2 (as applicable)	5
Internal Visual Examination	1580, para 10.1.1.4 or 10.14.4 (as applicable)	5
Dielectric Thickness Measurement	Note 2	3
SEM EDS Electrode Material	Note 2, Note 3	3

Notes:

- 1.) High Temperature Solder Verification required on lead attach.
- 2.) Testing is for information only.
- 3.) Testing is to determine if part uses Base Metal Electrode (BME) or Precious Metal Electrode (PME).

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4.1.4 Capacitors, Solid Tantalum Leaded

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 10.4, MIL-STD-202 and Table 4 herein. This includes but is not limited to the following styles of capacitors: CSR, CSS.

Table 4 – Capacitors, Solid Tantalum Leaded

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 10.4.1.1	5
Prohibited Materials Analysis	1580, para 10.4.1.2 and 10.4.1.6	1
Hermetic Seal - Fine - Gross	202, Method 112 cond C 202, Method 112 cond D (as applicable)	5
Terminal Strength	202, Method 211 cond A, C, or D (as applicable)	2
Decapsulation / Delid	1580, para 10.4.1.5	2
Cross section / Microscopic	1580, para 10.4.1.4	3
Internal Visual Examination	1580, para 10.4.3	5

4.1.5 Capacitors, Wet Tantalum Leaded

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 10.8, MIL-STD-202 and Table 5 herein.

Table 5 - Capacitors, Wet Tantalum Leaded

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 10.8.1.1	5
Prohibited Materials Analysis	1580, para 10.8.1.2	1
Hermetic Seal - Fine - Gross	202, Method 112, cond C 202, Method 112, cond D (as applicable)	5
Terminal Strength	202, Method 211, cond A, C ,or D (as applicable)	2
Decapsulation / Delid	1580, para 10.8.1.4	5
Internal Visual Examination	1580, para 10.8.3 & 10.8.3.1	5

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4.2 CONNECTORS

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 11.1, paragraph 11.2 and Table 6 herein.

Table 6 - Connectors

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 11.1.1.1	5
Prohibited Materials Analysis	1580, para 11.1.1.2 and 11.1.1.4	1
Electrical Test (Note 1)	1580, para 11.2.1.2	5
X-ray	1580, para 11.1.1.3	5
Insertion Force (Note 1)	1580, para 11.1.1.3a	5
Contact Retention (Note 1)	1580, para 11.1.1.3b	5
Plating Adhesion	1580, para 11.1.1.3d	5
Encapsulation/Cross Sectioning	1580, para 11.2.1.3 and 11.2.1.3.1 or 11.2.1.3.2	5
Plating Thickness Verification	1580, para 11.1.1.3c	5
Insulator Retention	1580, para 11.1.1.3e	5
SEM	1580, para 11.2.1.4 (as required)	

Notes:

- 1.) Required on connectors with contacts only, unless otherwise specified on the purchase order.

4.2.1 Discrete PCB Power Contacts

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 11.4, and Table 7 herein.

Table 7 - Contacts

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 11.4.1.1	5
Prohibited Materials Analysis	1580, para 11.4.1.2	1
Dimensions	1580, para 11.4.1.1.a	5
Plating Adhesion	1580, para 11.1.1.3.d	5
Encapsulation/Cross Sectioning	1580	5
Plating Thickness Verification	1580, para 11.4.1.1.c	5

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4.3 DIODES

4.3.1 Diodes, Voidless, Axial Leaded and Surface Mount

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 13.1, MIL-STD-750, and Table 8 herein.

Table 8 - Diodes, Voidless, Axial Leaded and Surface Mount

Test Description	Military Standard	Quantity
Electrical Testing - Subgroup A2	1580, para 13.1.1.1	5
Prohibited Materials Analysis	1580, para 13.1.1.6	1
External Visual Inspection	750, Method 2071	5
X-ray	750, Method 2076	5
Hermetic Seal	750, Method 1071, cond E	5
Terminal Strength	750, Method 2036 or 2038	5
Internal Visual Inspection	750, Method 2074	5
Cross Section / Microscopic (Note 2)	750, Method 2101	2
Scribe and Break (Note 3)	750, Method 2101, para 5.2 and para 5.2.1	3

Notes:

- 1.) RGA and PIND testing is not applicable to glass (void-less) diodes.
- 2.) Per MIL-STD-750 TM2101, Thermal Impedance testing may be used to validate integrity of die attach.
- 3.) The lot is acceptable if a device does not meet the die attach criteria, but the entire lot was subjected to 100% thermal response testing (Zojx) as part of screening.
- 4.) Resistance to Solvents and Solderability tests are not required.

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4.3.2 Diodes, Cavity Devices, Axial or Surface Mount

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 13.3, MIL-STD-750, and Table 9 herein.

Table 9 - Diodes, Cavity Devices

Test Description	Military Standard	Quantity
Electrical Testing - Subgroup A2	1580, para 13.1.1.1	5
External Visual Inspection	750, Method 2071	5
Prohibited Materials Analysis	1580, para 13.3.1.2 and 13.3.1.10	1
X-ray	750, Method 2076	5
Hermetic Seal - Fine - Gross	750, Method 1071 Cond G or H 750, Method 1071 Cond D or E	5
PIND	750, Method 2052 Cond A	5
Resistance to Solvents	750, Method 1022	5
Solderability	750, Method 2026	5
Terminal Strength	750, Method 2036 or 2038	5
Water Vapor Testing (RGA) (when applicable)	750, Method 1018	1
Crimp Tubulation Inspection	1580, para 13.3.1.8	5
Internal Visual Inspection	750, Method, 2074	5
Bond Pull	1580, para 13.3.1.11 (as applicable)	5
SEM	1580, para 13.3.1.12	2
Die Shear	1580, para 13.3.1.13	5

4.4 EMI FEED-THROUGH FILTERS

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 14.1, MIL-STD-202 and Table 10 herein.

Table 10 - EMI Feed Through Filters

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 14.1.1.1	5
Prohibited Materials Analysis	1580, para 14.1.1.2 and 14.1.1.8	1
Hermeticity - Fine - Gross	202, Method 112, cond C 202, Method 112, cond D (as applicable)	5
X-Ray	1580, para 14.1.1.4	5
Internal Visual Inspection	1580, para 14.1.1.6 and 14.1.3	4

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Test Description	Military Standard	Quantity
Chemical Decapsulation (if required)	1580, para 14.1.1.7	1

4.5 MAGNETIC DEVICES

4.5.1 Inductors, Transformers and Chip Inductors

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 15.1, MIL-STD-202 and Table11 herein.

Table 11 - Inductors, Transformers, and Chip Inductors

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 15.1.1.1	5
Prohibited Materials Analysis	1580, para 15.1.1.2 and 15.1.1.7	1
X-ray	1580, para 15.1.1.4	5
Hermeticity - Fine - Gross (Note 1)	202, Method 112 cond C 202, Method 112 cond D (as applicable)	5
Dissassembly	1580, para 15.1.1.5	3
Cross Sectioning (Note 2)	1580, para 15.1.1.6	2
Internal Visual Inspection (Notes 3, 4)	1580, para 15.1.3	5

Notes

- 1.) Hermeticity test is not required on chip inductor
- 2.) Cross Sectioning test is required on molded package only, when performed cross-section in planes that will reveal the most useful data (based on X-ray results).
- 3.) Document minimum wire size (ex: 38awg for S level and 44awg for B level).
- 4.) Document solder composition for internal connections. If not “High Temp” (Greater than 260C liquidus) Solder, disposition customer review.

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4.5.2 RF Coils

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 15.2 and Table 12 herein.

Table 12 - Coils

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 15.2.1.1	5
Prohibited Materials Analysis	1580, para 15.2.1.2 and 15.2.1.7	1
Terminal Strength	1580, para 15.2.1.3	2
Decapsulation	1580, para 15.2.1.4	3
Encapsulation/Cross Sectioning	1580, para 15.2.1.6	2
Internal Visual Inspection	1580, para 15.2.2.1 and 15.2.2.2	5

4.5.3 Ferrite Chips

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 15.3 and Table 13 herein.

Table 13 - Coils

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 15.3.1.1	5
Prohibited Materials Analysis	1580, para 15.3.2	1
Micro Sectioning	1580, para 15.3.3	5
Internal Visual Inspection	1580, para 15.3.5	5

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4.6 TRANSISTORS

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 21.1, MIL-STD-750 and Table 14 herein.

Table 14 – Transistors

Test Description	Military Standard	Quantity (Note 2)		
Electrical Testing - Subgroup A2	(Note 1)	5	3	1
External visual Inspection	1580, para 21.1.1.1	5	3	1
Prohibited Materials Analysis	1580, para 21.1.1.2 and 21.1.1.10	1	1	1
X-ray	1580, para 21.1.1.4	5	3	1
Hermetic Seal - Fine - Gross	1580, para 21.1.1.3, 1580, para 21.1.1.3	5	3	1
PIND	1580, para 21.1.1.5	5	3	1
Water vapor testing (RGA)	1580, para 21.1.1.6	1	1	1
Internal Visual Inspection / Decap	1580, para 21.1.1.9	5	3	1
Bond Pull (Note 3)	1580, para 21.1.1.11	5	3	1
SEM	1580, para 21.1.1.12	3	2	1
Die Shear	1580, para 21.1.1.13	5	3	1

Notes:

- 1.) Electrical Testing: Perform the appropriate Group A electrical tests per the transistor slash sheet or source control drawing. As minimum, the following tests shall performed:
 Bipolar: ICBO/BVCBO, IEBO/BVEBO and Hfe
 FET: IGSS/BVGSS, VP (pinch off) and BVDSS
- 2.) A 3 piece sample will be used on Rad-hard MOSFETs that are built and tested to JANTXV or JANS quality level or equivalent. When there are quality issues/concerns, the sample size can be temporarily increased until they are resolved.
- 3.) Photo documentation required for wirebond lifts of wire and pad

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4.7 MICROCIRCUITS

4.7.1 Microcircuits, Monolithic, PEM - DPA

DPA (Construction Analysis) testing shall be performed in accordance with MIL-STD-1580, paragraph 16.5, and Table 15 herein. This testing is also applicable to microcircuits manufactured using Flip-Chip technology.

Table 15 – Microcircuits, Monolithic, PEM, DPA

Test Description	Military Standard	Quantity (Note 15)
External Visual Inspection	1580, para 16.5.1.1	5
Prohibited Materials Analysis	1580, para 16.5.1.1.2	1
X-ray, 2 views	1580, para 16.5.1.2	5
Acoustic Microscopy (Note 1)	1580, para 16.5.1.3	5
Cross Section (See Notes 9, 10)	1580, para 16.5.1.4	1
Decapsulation	1580, para 16.5.1.5	4
Internal Visual Inspection (Notes 4, 5, 11, 12, 13)	1580, para 16.5.1.6	5
Glassivation Layer Integrity	1580, para 16.5.1.9	1
Bond Pull (Note 3)	1580, para 16.5.1.8	2
SEM (Notes 2, 6)	1580, para 16.5.1.10	2
SEM Overall Construction	See Note 7	2
Ball Shear Test	JESD22-B116 (50% of all balls)	2
Lead Material & Plating Thickness	See Note 8	1
DPA on passives	See Notes 12, 14	-

Notes:

- 1.) Acoustic Microscopy non-conformances require customer review.
- 2.) The step coverage evaluation of the metallization layer shall include and document the location of the measurements as well as the thickness of the layer. Thinning step metal coverage is not cause for rejection. Current density or documented design rules shall be used for lot acceptance.

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- 3.) Bond wires can be weakened during decapsulation, therefore, further evaluation may be required to determine legitimate failures. Photo documentation is required for wirebond lifts of wire and pad. Wire bond non-conformances require customer review.
- 4.) When standard pin out per Manufacturer spec is not used, a wirebond diagram/photo shall be included in the report to correlate wirebond pull to location. If not all wires are pulled, note reason why (example, wire nicked, damaged during decap, etc.).
- 5.) All IC and MOSFET dice shall be photographed to document markings, including the manufacturer, part number and revision, as applicable.
- 6.) Die without glassivation is prohibited.
- 7.) Sample(s) shall be inspected, using the SEM, for any assembly-related deficiencies, i.e. wirebonds, die bond, and overall glassivation. A photograph of the worst case general glassivation and an overall photograph of the internal cavity shall be made.
- 8.) Sample(s) shall be cross sectioned perpendicular to the longitudinal axis. A qualitative analysis of the lead material shall be provided. The plating and barrier metallization thickness shall be measured in a sufficient number of spots to provide a representative average value
- 9.) The die cross section should be suitable to verify metal step coverage, glassivation thickness, metal thickness and should go through the center of tungsten plugs used in planar devices
- 10.) Photo shall include cross section plane (show on part where cross section was performed).
- 11.) Die size measurements shall be included in report.
- 12.) Identify passive components plating and attach material (prohibited materials), as applicable.
- 13.) Document the means of interconnect between the die, substrate and any additional materials used for both single die and multiple die construction.
- 14.) Microcircuits, including Flip-Chip construction, may have additional passive components internal and external to the package. A 5 piece DPA is also required on passive elements per the applicable section.
- 15.) For sample sizes other than 5 contact SEAKR Engineering for instructions.

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4.7.2 Microcircuits, Monolithic and Multi-Chip Modules

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 16.1, and Table 16 herein.

Table 16 - Microcircuits, Monolithic and Multi-chip Modules

Test Description	Military Standard	Quantity (Note 4)		
External Visual Inspection	1580, para 16.1.1.1	5	3	1
Prohibited Materials Analysis	1580, para 16.1.1.2 and 16.1.1.7	1	1	1
Hermetic Seal	1580, para 16.1.1.3	5	3	1
X-ray	1580, para 16.1.1.4	5	3	1
PIND	1580, para 16.1.1.5	5	3	1
Water Vapor Testing (RGA)	1580, para 16.1.1.6	1	1	1
Internal Visual Inspection (Notes 3, 6, 7, 8, 9)	1580, para 16.1.1.8	5	3	1
Bond Pull (Note 10)	1580, para 16.1.1.9	2	2	1
SEM (Notes 2, 5)	1580, para 16.1.1.10	2	2	1
Die Shear	1580, para 16.1.1.11	2	2	1
DPA on passive elements	(Note 1, 9)	-	-	-

Notes:

- 1.) Custom ASICs are considered monolithic microcircuits with passive elements (i.e. bypass capacitors) internal and external to the package. A 5 piece DPA (or 100% if less than 5 pieces available) is also required on any passive element per applicable section.
- 2.) The step coverage evaluation of the metallization layer shall include and document the location of the measurements as well as the thickness of the layer. Thinning step metal coverage is not cause for rejection. Current density or documented design rules shall be used for lot acceptance.
- 3.) All IC and MOSFET dice shall be photographed to document the manufacturer, part number and revision, as applicable.
- 4.) The sample size may be adjusted per paragraph 3.1.
- 5.) Die without glassivation is prohibited.
- 6.) Wirebond diagram/photo shall be included in the report to correlate wirebond pull data to location. If not all wires are pulled, note reason why (example, wire nicked, damaged during decap, etc.).

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- 7.) Photo to include cross section plane (show on part where cross section was performed), when applicable.
- 8.) Die size measurements shall be determined in die shear test or internal visual.
- 9.) Identify passive components plating and attach material (prohibited materials), when applicable.
- 10.) Photo documentation required for wirebond lifts of wire and pad.

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4.8 HYBRID MICROCIRCUITS

4.8.1 Hybrid Microcircuits, Optocouplers, Crystal Oscillators

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 16.1, and Table 17 herein.

Table 17 - Hybrid Microcircuits, Optocouplers, and Crystal Oscillators

Test Description	Military Standard	Quantity (Note 3)		
External Visual Inspection	1580, para 16.1.1.1	5	3	1
Prohibited Materials Analysis	1580, para 16.1.1.2 and 16.1.1.7	1	1	1
Hermetic Seal	1580, para 16.1.1.3	5	3	1
X-RAY	1580, para 16.1.1.4	5	3	1
PIND	1580, para 16.1.1.5	5	3	1
Water Vapor Testing (RGA)	1580, para 16.1.1.6	3	2	1
Internal Visual Inspection (Note 2,5,6)	1580, para 16.1.1.8	5	3	1
Bond Pull (Note 7)	1580, para 16.1.1.9	2	2	1
SEM (Notes 1, 4)	1580, para 16.1.1.10	2	2	1
Die Shear	1580, para 16.1.1.11	2	2	1
Passive Element Shear Test	1580, para 16.1.1.12	2	1	1

Notes:

- 1.) The step coverage evaluation of the metallization layer shall include and document the location of the measurements as well as the thickness of the layer. Thinning step metal coverage is not cause for rejection. Current density or documented design rules shall be used for lot acceptance.
- 2.) All IC and MOSFET dice shall be photographed to document the markings, including manufacturer, part number and revision, as applicable.
- 3.) The sample size will be reduced to 3 pieces for oscillators, Rad-hard IC's, EMI filters. The sample size will be reduced to 1 piece for 1553 hybrids, Rad-hard Multi-Chip Modules, DC-DC converters, and fiber-optic hybrids. A 100% pre-cap visual inspection is typically performed by SEAKR on all oscillators and hybrids. Oscillators can combine DPA samples from various frequencies of a single production lot. When there are quality issues/concerns, the sample size can be temporarily increased until they are resolved.

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- 4.) Die without glassivation is prohibited.
- 5.) Die size measurements shall be included in report.
- 6.) When cross section is performed, provide photographs of the cross section plane.
- 7.) Photo documentation required for wirebond lifts of wire and pad.

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4.9 RESISTORS

4.9.1 Resistors, Fixed, Film, Chip

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 18.5 and Table 18 herein. This includes but it is not limited to the following styles: RM

Table 18 – Resistors, Fixed, Film, Chip

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 18.5.1.1	5
Prohibited Materials Analysis	1580, para 18.5.1.1.1	1
Cross-Section	1580, para 18.5.4	1

4.9.2 Resistors, Metal Film Leaded

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 18.3, MIL-STD-202, and Table 19 herein. This includes but it is not limited to the following styles of resistors: RLR and RNC

Table 19 – Resistors, Metal Film Leaded

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 18.3.1.1	5
Prohibited Materials Analysis	1580, para 18.3.1.3 and 18.3.1.4.3	1
Hermetic Seal - Fine - Gross	202, Method 112, cond C 202, Method 112, cond D (as applicable)	5
Decapsulation / Delid	1580, para 18.3.1.4.1 and 18.3.1.4.2	5
Internal Visual Examination	1580, para 18.3.3	5
Removal of Internal End Caps	1580, para 18.3.1.5	5

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4.9.3 Resistors, Metal Foil Leaded and Chip

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 18.4., MIL-STD-202, and Table 20 herein. This includes but it is not limited to the following styles of resistors: RNC90, VSM / VSMP

Table 20 – Resistors, Metal Foil Leaded and Chip

Test Description	Military Standard	Quantity
External Visual Inspection (Note 1)	1580, para 18.4.1.1	5
Prohibited Materials Analysis	1580, para 18.4.1.2	1
Terminal Strength	202, Method 211, cond A, C or D (as applicable)	1
Decapsulation / Delid (Note 3)	1580, para 18.4.1.4 and para 18.4.4	5
Internal Visual Examination (Note 2,3,4)	1580, para 18.4.3	5

Notes:

- 1.) Note any lifting or peeling termination metal on chip resistors.
- 2.) Note particles, bridges and / or voids in metal traces during internal visual.
- 3.) SEM inspection may be used to assist in anomaly identification.
- 4.) If part is rejected or dispositioned for customer review for voids, bridges or particles, it shall be noted whether these anomalies are in the active trace.

4.9.4 Resistors, Wire-wound Leaded

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 18.8, and Table 21 herein. This includes but it is not limited to the following styles of resistors: RWR

Table 21 – Resistors, Wirewound Leaded

Test Description	Military Standard	Quantity
External Visual inspection	1580, para 18.8.1.1	5
Prohibited Materials Analysis	1580, para 18.8.1.2	1
X-ray	1580, para 18.8.1.3 and 18.8.3	5
Decapsulation / Delid	1580, para 18.8.1.4.1 or 18.8.1.4.2	5
Internal Visual Examination	1580, para 18.8.3	5

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4.9.5 Resistor Networks

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 18.6, MIL-STD-202, and Table 22 herein. This includes but it is not limited to the following styles of resistors: RZ

Table 22 - Resistor Networks

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 18.6.1.1	5
Prohibited Materials Analysis	1580, para 18.6.1.2	1
Hermetic Seal	1580, para 18.6.1.3	5
Pull Test (Note 1)	202, Method 211, cond A	2
De-capsulation / Delid	1580, para 18.6.1.5	5
Internal Visual Examination	1580, para 18.6.1.6 and 18.6.3 through 18.6.3.7	5

Notes:

- 1.) Applicable to molded package styles only.

4.10 THERMISTORS

4.10.1.1 Thermistor, glass bodied, hermetic

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 20.1 and Table 23 herein.

Table 23 - Thermistor, glass bodied, hermetic

Test Description	Military Standard	Quantity
Prohibited Materials Analysis	1580, para 18.5.1.1.1	1
Prohibited Materials Analysis	1580, para 20.1.1.2	1
Sample Preparation	1580, para 20.1.1.3	5
Internal Visual Examination	1580, para 20.1.1.4 and 20.1.3	5

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4.10.1.2 Thermistors disc and bead encapsulated

DPA testing shall be performed in accordance with MIL-STD-1580, paragraph 20.2 and Table 24 herein.

Table 24 - Thermistor, disc and bead encapsulated

Test Description	Military Standard	Quantity
External Visual Inspection	1580, para 20.2.1.1	5
Sample Preparation	1580, para 20.2.1.2	5
Prohibited Materials Analysis	1580, para 20.2.1.3	1
Internal Visual Examination	1580, para 20.2.1.4 and 20.2.3	5

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