# DISCRETE MICROWAVE SEMICONDUCTOR COMPONENTS, HERMETICALLY SEALED AND DIE

## ESCC Generic Specification No. 5010

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## DOCUMENTATION CHANGE NOTICE

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| 904 994 1027 | Specification upissued to incorporate changes per DCR. |

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# 1 INTRODUCTION

## 1.1 SCOPE

This specification defines the general requirements for the qualification, qualification maintenance, procurement, and delivery of hermetically sealed, packaged and die, discrete microwave, semiconductor components for space applications. This specification contains the appropriate inspection and test schedules and also specifies the data documentation requirements.

## 1.2 APPLICABILITY

This specification is primarily applicable to the granting of qualification approval to components qualified in accordance with one of the following ESCC methods:

- Qualification of Standard Components per ESCC Basic Specification No. 20100.
- Technology Flow Qualification per ESCC Basic Specification No. 25400.

It is also primarily applicable to the procurement of components so qualified.

This specification may also be applied to the procurement of unqualified components, recommendations for which are given in ESCC Basic Specification No. 23100.

# 2 APPLICABLE DOCUMENTS

The following documents form part of, and shall be read in conjunction with, this specification. The relevant issues shall be those in effect on the date of starting qualification or placing the Purchase Order.

## 2.1 ESCC SPECIFICATIONS

- No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.
- No. 20400, Internal Visual Inspection.
- No. 20500, External Visual Inspection.
- No. 20600, Preservation, Packaging and Dispatch of ESCC Components.
- No. 20900, Radiographic Inspection of Electronic Components.
- No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.
- No. 21400, Scanning Electron Microscope Inspection of Semiconductor Dice.
- No. 21700, General Requirements for the Marking of ESCC Components.
- No. 22600, Requirements for the Evaluation of Standard Electronic Components for Space Application.
- No. 22800, ESCC Non-Conformance Control System.
- No. 22900, Total Dose Steady-State Irradiation Test Method.
- No. 23100, Recommendations on the use of the ESCC Specification System for the Evaluation and Procurement of Unqualified Components.
- No. 23500, Lead Materials and Finishes for Components for Space Application.
- No. 23800, Electrostatic Discharge Sensitivity Test Method.
- No. 24600, Minimum Quality System Requirements.
- No. 24800, Resistance to Solvents of Marking, Materials and Finishes.

- No. 25400, Requirements for the Technology Flow Qualification of Electronic Components for Space Application

For qualification and qualification maintenance or procurement of qualified components, with the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800, 24600 and 25400, where Manufacturers' specifications are equivalent to, or more stringent than, the ESCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the ESCC Executive.

Such replacements shall be clearly identified in the applicable Process Identification Document (PID).

For procurement of unqualified components, where Manufacturers' specifications are equivalent to or more stringent than the ESCC Basic Specifications listed above, they may be used in place of the latter subject to the approval of the Orderer.

Such replacements may be listed in an appendix to the appropriate Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

Unless otherwise stated herein, references within the text of this specification to "the Detail Specification" shall mean the relevant ESCC Detail Specification.

2.2 OTHER (REFERENCE) DOCUMENTS

- MIL-STD-750, Test Methods for Semiconductor Devices.

2.3 ORDER OF PRECEDENCE

For the purpose of interpretation and in case of conflict with regard to documentation, the following order of precedence shall apply:

(a) ESCC Detail Specification
(b) ESCC Generic Specification
(c) ESCC Basic Specification
(d) Other documents, if referenced herein

## 3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

The terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply. In addition the following shall apply:

- Packaged Component: A semiconductor device designed to be delivered after encapsulation.
- Die Component: A semiconductor device designed to be delivered without encapsulation.

# 4 REQUIREMENTS

## 4.1 GENERAL

The requirements for the qualification of a component shall be in accordance with ESCC Basic Specification No. 20100.

The requirements for Technology Flow Qualification and the listing of qualified component types shall be in accordance with ESCC Basic Specification No. 25400.

The test requirements for procurement of both qualified and unqualified Packaged Components (see Chart F1A) shall comprise:

- Wafer Lot Acceptance with, if stipulated in the Purchase Order, total dose radiation testing.
- Special In-Process Controls.
- Screening Tests.
- Periodic Testing (for qualified components only).
- Lot Validation Testing if stipulated in the Purchase Order.

The test requirements for procurement of both qualified and unqualified Die Components (See Chart F1B) shall comprise:

- Wafer Lot Acceptance with, if stipulated in the Purchase Order, total dose radiation testing.
- Special In-Process Controls (on Packaged Test Sublot samples).
- Screening Tests (on Packaged Test Sublot samples).
- Periodic Testing (for qualified components only; on Packaged Test Sublot samples).
- Lot Validation Testing if stipulated in the Purchase Order (on Packaged Test Sublot samples).

### 4.1.1 Specifications

For qualification, qualification maintenance, procurement and delivery of components in conformity with this specification, the applicable specifications listed in Section 2 of this document shall apply in total unless otherwise specified herein or in the Detail Specification.

### 4.1.2 Conditions and Methods of Test

The conditions and methods of test shall be in accordance with this specification, the ESCC Basic Specifications referenced herein and the Detail Specification.

### 4.1.3 Manufacturer's Responsibility for Performance of Tests and Inspections

The Manufacturer shall be responsible for the performance of tests and inspections required by the applicable specifications. These tests and inspections shall be performed at the plant of the Manufacturer of the components unless it is agreed by the ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components), to use an approved external facility.

### 4.1.4 Inspection Rights

The ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components if stipulated in the Purchase Order) reserves the right to monitor any of the tests and inspections scheduled in the applicable specifications.

4.1.5 Customer Source Inspections

*4.1.5.1 Pre-Encapsulation Customer Source Inspection*

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility prior to encapsulation (e.g. perform Internal Visual Inspection, witness of Bond Pull and Die Shear). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

*4.1.5.2 Final Customer Source Inspection*

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility prior to delivery at an appropriate point during testing that has been agreed with the Manufacturer (e.g. perform Die Visual Inspection for Die Components; witness of final Room Temperature Electrical Measurements; performance of External Visual Inspection and Dimension Check; review of the data documentation package). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

4.2 QUALIFICATION AND QUALIFICATION MAINTENANCE REQUIREMENTS ON A MANUFACTURER

To obtain and maintain the qualification of a component, or family of components, a Manufacturer shall satisfy the requirements of ESCC Basic Specification No. 20100.

To obtain and maintain the qualification of a component produced using a qualified Technology Flow, a Manufacturer shall satisfy the requirements of ESCC Basic Specification No. 25400.

4.3 DELIVERABLE COMPONENTS

4.3.1 ESCC Qualified Components

Components delivered to this specification shall be processed and inspected in accordance with the relevant Process Identification Document (PID).

4.3.2 ESCC Components

Each component, irrespective of qualification status, identified with an ESCC component number and delivered to this specification shall:

- be traceable. Each Packaged Component shall be traceable to its production lot. Each Die Component shall be traceable to its wafer and wafer lot.
- have satisfactorily completed all the tests required by the relevant issues of the applicable specifications.
- be produced from lots that are considered by the Manufacturer to be capable of passing all applicable tests, and sequences of tests, that are defined in Chart F4A or F4B (as applicable). The Manufacturer shall not knowingly supply components that cannot meet this requirement. In the event that, subsequent to delivery and prior to operational use, a component is found to be in a condition such that, demonstrably, it could not have passed these tests at the time of manufacture, this shall be grounds for rejection of the delivered lot.

4.3.3 Lot Failure

Lot failure may occur during Wafer Lot Acceptance (Chart F2), Special In-Process Controls (Chart F2), Screening Tests (Charts F3A and F3B), or Qualification, Periodic Testing and Lot Validation Testing (Charts F4A and F4B).

Should such failure occur during qualification, qualification maintenance or procurement of qualified components the Manufacturer shall initiate the non-conformance procedure in accordance with ESCC Basic Specification No. 22800. The Manufacturer shall notify the Orderer and the ESCC Executive by any appropriate written means, within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing or analysis shall be performed on the failed components until so instructed by the ESCC Executive.

Should such failure occur during procurement of unqualified components the Manufacturer shall notify the Orderer by any appropriate written means within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing or analysis shall be performed on the failed components until so instructed by the Orderer. The Orderer shall inform the Manufacturer within 5 working days of receipt of notification what action shall be taken.

4.4 MARKING

All components procured and delivered to this specification shall be marked in accordance with ESCC Basic Specification No. 21700.

For Die Components, the specified marking shall not be marked on the component but shall accompany the component, in full, in its primary package. For Die Components, lot identification shall also include wafer and wafer lot numbers.

4.5 MATERIALS AND FINISHES

Specific requirements for materials and finishes are specified in the Detail Specification. Where a definite material or finish is not specified a material or finish shall be used so as to ensure that the component meets the performance requirements of this specification and the Detail Specification. Acceptance or approval of any constituent material or finish does not guarantee acceptance of the finished product.

Unless otherwise specified in the Detail Specification, Packaged Components shall be hermetically sealed.

For Die Components, see Para. 4.7 for the minimum material requirements that shall be specified in the Detail Specification.

All materials and finishes of the components specified in the Detail Specification shall comply with the restrictions on materials specified in ESCC Basic Specification No. 22600.

4.6 RADIATION TESTING

For qualification or qualification maintenance, total dose radiation testing shall be performed when specified in the Detail Specification to the specified total dose level.

For procurement, as stipulated in the Purchase Order, total dose radiation testing shall be performed to the total dose level specified in the Detail Specification or to an alternate level if so stipulated in the Purchase Order.

The qualification status of the procured components shall not be impacted by any change to the total dose level applied.

For procurement, any lot of components that fails the specified total dose radiation test level may be accepted to a lower level of radiation subject to satisfactory test results at the lower level. In this case the total dose radiation level letter for the lot shall be modified accordingly.

4.7 DIE COMPONENTS

For Die Components, the Detail Specification shall, as a minimum, specify the following:

(a) Materials:
- Die substrate material
- Glassivation material
- Top metallisation material
- Backside metallisation material (if applicable)

(b) Terminal Identification and the applicable bias details for:
- All bonding pads
- Die substrate/backside contact

(c) Dimensions:
- Die length, width and thickness
- Glassivation thickness
- Top metallisation thickness
- Backside metallisation thickness (if applicable)
- Die topography details including all bonding pad dimensions

## 5 PRODUCTION CONTROL

5.1 GENERAL

Unless otherwise specified herein or in the Detail Specification, all lots of components used for qualification and qualification maintenance, Lot Validation Testing and for delivery shall be subject to tests and inspections in accordance with Chart F2 in the sequence shown.

Any components which do not meet these requirements shall be removed from the lot and at no future time be resubmitted to the requirements of this specification.

The applicable test requirements are detailed in the paragraphs referenced in Chart F2.

For qualified components, the full production control provisions are defined in the PID.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

5.2 WAFER LOT ACCEPTANCE

5.2.1 Process Monitoring Review

Process monitoring review shall be done in compliance with the Manufacturer's SPC rules described in the PID (for qualification, qualification maintenance or procurement of qualified components).

A wafer shall be rejected if one or more process control data parameters exceed the allowed distribution as specified in the PID (for qualification, qualification maintenance or procurement of qualified components).

5.2.2 Wafer Screening

Wafer Screening of Die Components shall consist of the following tests and inspections:

(a) Go-no-go Room Temperature Electrical Measurements in accordance with Para. 8.1.1.1, either as an on-wafer measurement or after dice separation.

(b) Go-no-go High and Low Temperatures Electrical Measurements performed on test samples in accordance with Para. 8.1.2.1, either as an on-wafer measurement or after dice separation. If the number of permitted failures is exceeded, the wafer shall be rejected.

(c) Die Visual Inspection in accordance with Para. 8.2, after dice separation.

**NOTE:**
Die Visual Inspection may be performed on a selected sublot basis. The selected sublot shall consist of a minimum of the Die Components necessary for delivery, testing and allowable failures.

5.2.3 Die Dimensions

See Para. 4.7 for the minimum dimension requirements for Die Components that shall be specified in the Detail Specification. The dimensions of the Die Components as specified in the Detail Specification shall be guaranteed but not tested

5.2.4 Scanning Electron Microscope (SEM) Inspection

Components supplied to this specification shall be produced from wafer lots that have been subjected to and successfully met the Scanning Electron Microscope Inspection requirements in accordance with Para. 8.3.

5.2.5 Total Dose Radiation Testing

For qualification or qualification maintenance:

- If specified in the Detail Specification, components shall be produced from a wafer lot which has been subjected to and successfully completed Total Dose Radiation Testing in accordance with Para. 8.4 to the specified total dose level.

During procurement:

- If specified in the Detail Specification and stipulated in the Purchase Order, components shall be produced from a wafer lot which has been subjected to and successfully completed Total Dose Radiation Testing in accordance with Para. 8.4 to the stipulated total dose level.

5.2.6 Documentation

Documentation of Wafer Lot Acceptance shall be in accordance with Para. 9.5.

5.3 SPECIAL IN-PROCESS CONTROLS

5.3.1 Assembly of the Packaged Test Sublot for Die Components

For Die Components, sample dice shall be selected at random from each wafer and assembled into suitable packages. These samples make up the Packaged Test Sublot. The minimum quantity of dice to be assembled shall be:

(a) Die area ≤ 0.3mm$^2$: 24 dice per wafer.

(b) Die area > 0.3mm$^2$ ≤ 1mm$^2$: 4 dice per wafer and 16 dice per wafer lot.

(c) Die area > 1mm$^2$: 3 dice per wafer and 12 dice per wafer lot.

The actual quantity of dice assembled shall be such that the above quantity is available for submission to Burn-in 1 (or Burn-in 2 if Burn-in 1 is not being performed) in accordance with Chart F3B plus there are enough components available after Screening Tests to satisfy the total quantity required for Qualification Testing, Periodic Testing or Lot Validation Testing, as applicable.

In the case when a production lot of Packaged Components of the same type as the Die Components has been assembled with equivalent wafer and wafer lot sampling as above, for the purposes of testing, the components subjected to Special In-Process Controls, Screening Tests, and Qualification and Periodic Tests may be considered as the Packaged Test Sublot.

In addition to the above quantities, the following minimum quantities of dice shall also be selected and assembled for use in Bond Strength and Die Shear tests during Special In-Process Controls:

(a) Die area ≤ 1mm$^2$: 3 dice per wafer.

(b) Die area > 1mm$^2$: 2 dice per wafer.

5.3.2 Internal Visual Inspection

Internal Visual Inspection shall be performed on assembled components in accordance with Para. 8.2.

For Die Components, testing shall be performed on the Packaged Test Sublot.

5.3.3 Bond Strength and Die Shear

Bond Strength and Die Shear tests shall be performed on test samples in accordance with Para. 8.5. A single failure shall be cause for lot failure. These tests are considered as destructive and therefore components so tested shall not form part of the delivery lot.

5.3.4 Dimension Check

Dimension Check shall be performed in accordance with Para. 8.6 on 3 samples only. In the event of any failure a 100% Dimension Check shall be performed.

5.3.5 Weight

The maximum weight of the component specified in the Detail Specification shall be guaranteed but not tested.

5.3.6 Documentation

Documentation of Special In-Process Controls shall be in accordance with Para. 9.6.

## 6 SCREENING TESTS

6.1 GENERAL

Unless otherwise specified herein or in the Detail Specification, all lots of components used for qualification and qualification maintenance, Lot Validation Testing, and for delivery, shall be subjected to tests and inspections in accordance with Chart F3A for Packaged Components and Chart F3B for Die Components, in the sequence shown.

For Die Components, testing shall be performed on the Packaged Test Sublot.

All components shall be serialised (prior to the initial measurements of Parameter Drift Values).

Any components which do not meet these requirements shall be removed from the lot and at no future time be resubmitted to the requirements of this specification.

The applicable test methods and conditions are specified in the paragraphs referenced in Charts F3A and F3B.

6.2 FAILURE CRITERIA

6.2.1 Environmental and Mechanical Test Failure

The following shall be counted as component failures:

- Components which fail during tests for which the pass/fail criteria are inherent in the test method, i.e. PIND, Radiographic Inspection, Seal and External Visual Inspection.

6.2.2 Parameter Drift Failure

The acceptable change limits are shown in Parameter Drift Values in the Detail Specification. A component shall be counted as a parameter drift failure if the changes during Burn-in 1 or Burn-in 2 are larger than the drift values ($\Delta 1$, $\Delta 2$) specified.

6.2.3 Parameter Limit Failure

A component shall be counted as a limit failure if one or more parameters exceed the limits shown in Room Temperature Electrical Measurements or High and Low Temperatures Electrical Measurements in the Detail Specification.

For Packaged Components, any component which exhibits a limit failure prior to the submission to Burn-in 1 shall be rejected and not counted when determining lot rejection.

6.2.4 Other Failures

A component shall be counted as a failure in any of the following cases:

- Visual failure.
- Mechanical failure.
- Handling failure.
- Lost component.

6.3 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 6.2.

6.4 LOT FAILURE

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

6.4.1 Lot Failure for Packaged Components

*6.4.1.1 Lot Failure during 100% Testing*

If the number of components failed on the basis of the failure criteria specified in Paras. 6.2.2 and 6.2.3 exceeds 10% (PDA3) (rounded upwards to the nearest whole number) of the components submitted to Burn-in 1 (or Burn-in 2 if Burn-in 1 is not being performed) of Chart F3A, the lot shall be considered as failed.

In addition, if the number of components failed on the basis of the failure criteria specified in Paras. 6.2.2 and 6.2.3 exceeds the individual PDA specified for Burn-in 1 (PDA1 = 5%) or Burn-in 2 (PDA2 = 5%) (each rounded upwards to the nearest whole number) based on the quantity of components submitted to each burn-in, the lot shall be considered as failed.

If a lot is composed of groups of components of one family defined in one ESCC Detail Specification, but separately identifiable for any reason, then the lot failure criteria shall apply separately to each identifiable group.

*6.4.1.2 Lot Failure during Sample Testing*

A lot shall be considered as failed if the number of allowable failures during sample testing as specified herein or in the Detail Specification, is exceeded.

Unless otherwise specified, if a lot failure occurs, a 100% testing may be performed but the cumulative percent defective shall not exceed that specified in Para. 6.4.1.1.

6.4.2 Lot Failure for Die Components

*6.4.2.1 Lot Failure Prior to Burn-in Testing of the Packaged Test Sublot*

If the number of components failed during Room Temperature Electrical Measurements , and High and Low Temperatures Electrical Measurements (if performed) prior to Burn-in 1 in Chart F3B, on the basis of the failure criteria specified in Para. 6.2.3, exceeds 10% (PDA0) (rounded upwards to the nearest whole number) of the components submitted, the wafer lot shall be considered as failed.

*6.4.2.2 Lot Failure After Burn-in Testing of the Packaged Test Sublot*

If the number of components failed during each Parameter Drift Values subsequent to Burn-in 1 and Burn-in 2 in Chart F3B, on the basis of the failure criteria specified in Paras. 6.2.2 and 6.2.3, exceeds the individual PDA specified for Burn-in 1 (PDA1 = 5%) or Burn-in 2 (PDA2 = 5%) (rounded upwards to the nearest whole number) based on the quantity of components submitted to each burn-in, the wafer lot shall be considered as failed.

In addition, if the total number of components failed during Parameter Drift Values, Room Temperature Electrical Measurements, and High and Low Temperatures Electrical Measurements at any point during Chart F3B, on the basis of the failure criteria specified in Paras. 6.2.2 and 6.2.3, exceeds 10% (PDA3) (rounded upwards to the nearest whole number) of the components submitted to Serialisation of Chart F3B, the wafer lot shall be considered as failed.

6.5 DOCUMENTATION

Documentation of Screening Tests shall be in accordance with Para. 9.7.

## 7 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING

The requirements of this paragraph are applicable to the tests performed on components or test structures as part of qualification or qualification maintenance in accordance with either ESCC Basic Specification No. 20100 or 25400 as applicable. They are also applicable to Lot Validation Testing as part of the procurement of qualified or unqualified components.

### 7.1 QUALIFICATION TESTING

#### 7.1.1 General

Qualification testing shall be in accordance with the requirements specified in Chart F4A for Packaged Components or Chart F4B for Die Components.

For Packaged Components, the tests of Chart F4A shall be performed on the specified sample chosen at random from the components which have successfully passed the tests in Chart F3A.

For Die Components, the tests of Chart F4B shall be performed on the specified sample chosen at random from the components of the Packaged Test Sublot, which have successfully passed the tests in Chart F3B.

This sample constitutes the Qualification Test Lot. The Qualification Test Lot is divided into subgroups of tests and, unless otherwise specified all components assigned to a subgroup shall be subjected to all of the tests in that subgroup, in the sequence shown. The applicable test requirements are detailed in the paragraphs referenced in Charts F4A and F4B.

The conditions governing qualification testing are specified in ESCC Basic Specification No. 20100.

#### 7.1.2 Distribution within the Qualification Test Lot

Where a Detail Specification covers a range, or series of components that are considered similar, then the Qualification Test Lot shall be comprised of component types so selected that they adequately represent all of the various mechanical, structural and electrical peculiarities of that range or series.

The distribution shall be as specified by, or agreed with, the ESCC Executive.

### 7.2 QUALIFICATION WITHIN A TECHNOLOGY FLOW

The qualification of a component produced using a qualified Technology Flow shall be in accordance with ESCC Basic Specification No. 25400.

### 7.3 QUALIFICATION MAINTENANCE (PERIODIC TESTING)

Qualification is maintained through periodic testing and the test requirements of Para. 7.1 shall apply. For each subgroup, the sample size, the test requirements and the period between successive subgroup testing shall be as specified in Chart F4A for Packaged Components and Chart F4B for Die Components.

The conditions governing qualification maintenance are specified in ESCC Basic Specification No. 20100.

Qualification of a component, produced using a qualified Technology Flow, is maintained by the maintenance of the Technology Flow Qualification itself in accordance with ESCC Basic Specification No. 25400.

7.4 LOT VALIDATION TESTING

For procurement of qualified Packaged Components or qualified Die Components, Lot Validation Testing is not required and shall only be performed if specifically stipulated in the Purchase Order.

For procurement of unqualified Packaged Components or unqualified Die Components, the need for Lot Validation Testing shall be determined by the Orderer (ref. ESCC Basic Specification No. 23100).

When Lot Validation Testing is required, it shall consist of the performance of one or more of the tests or subgroup test sequences of Chart F4A or F4B (as applicable). The testing to be performed and the sample size shall be as stipulated in the Purchase Order.

When procurement of more than one component type is involved from a family, range or series, the selection of representative samples shall also be stipulated in the Purchase Order.

7.5 FAILURE CRITERIA

The following criteria shall apply to qualification, qualification maintenance and Lot Validation Testing.

7.5.1 Environmental and Mechanical Test Failure

The following shall be counted as component failures:

- Components which fail during tests for which the pass/fail criteria are inherent in the test method, e.g. Seal, Terminal Strength, etc.

7.5.2 Electrical Failure

The following shall be counted as component failures:

- Components which fail one or more of the applicable limits at each of the relevant data points specified for environmental, mechanical and endurance testing in Intermediate and End-Point Electrical Measurements in the Detail Specification.

7.5.3 Other Failures

A component shall be counted as a failure in any of the following cases:

- Visual failure.
- Mechanical failure.
- Handling failure.
- Lost component.

7.6 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 7.5.

When requested by the ESCC Executive (for qualification, qualification maintenance or procurement of qualified components) or the Orderer (for procurement of qualified or unqualified components), failure analysis of failed components shall be performed under the responsibility of the Manufacturer and the results provided.

Failed components shall be retained at the Manufacturer's plant until the final disposition has been agreed and certified.

7.7 LOT FAILURE

For qualification and qualification maintenance, the lot shall be considered as failed if one component in any subgroup of Chart F4A or F4B (as applicable) is a failed component based on the criteria specified in Para. 7.5.

For procurement, the lot shall be considered as failed if one component in any test specified for Lot Validation Testing is a failed component based on the criteria specified in Para. 7.5.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

7.8 QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING SAMPLES

All tests of Charts F4A and F4B are considered to be destructive and therefore components so tested shall not form part of the delivery lot.

7.9 DOCUMENTATION

Documentation of Qualification, Periodic Testing and Lot Validation Testing shall be in accordance with Para. 9.8.

## 8 TEST METHODS AND PROCEDURES

If a Manufacturer elects to eliminate or modify a test method or procedure, the Manufacturer is still responsible for delivering components that meet all of the performance, quality and reliability requirements defined in this specification and the Detail Specification.

For a qualified component, documentation supporting the change shall be approved by the ESCC Executive and retained by the Manufacturer. It shall be copied, when requested, to the ESCC Executive. The change shall be specified in an appendix to the Detail Specification and in the PID.

For an unqualified component, the change shall be approved by the Orderer. The change may be specified in an appendix to the Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

8.1 ELECTRICAL MEASUREMENTS

8.1.1 Room Temperature Electrical Measurements

*8.1.1.1 Room Temperature Electrical Measurements during Wafer Lot Acceptance (Chart F2)*

Unless otherwise specified, go-no-go Room Temperature Electrical Measurements shall be performed as specified in the Detail Specification. All failed dice shall be clearly identified.

*8.1.1.2 Room Temperature Electrical Measurements during Screening Tests (Charts F3A and F3B)*

Room Temperature Electrical Measurements shall be performed as specified in the Detail Specification. Unless otherwise specified, all values obtained shall be recorded against serial numbers.

8.1.2 High and Low Temperatures Electrical Measurements

*8.1.2.1 High and Low Temperatures Electrical Measurements during Wafer Lot Acceptance (Chart F2)*

Unless otherwise specified, go-no-go High and Low Temperatures Electrical Measurements shall be performed as specified in the Detail Specification. The measurements shall be performed on a sample of 5 dice from each wafer chosen at random. In the event of any failure a second sample of 13 dice shall be selected from the wafer at random and the measurements repeated. If any further failure occurs the wafer shall be rejected. All failed dice shall be clearly identified.

*8.1.2.2 High and Low Temperatures Electrical Measurements during Screening Tests (Charts F3A and F3B)*

Unless otherwise specified, High and Low Temperatures Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers. The measurements shall be performed on a sample of 5 components with 0 failures allowed.

For Packaged Components, in the event of any failure, a 100% inspection may be performed.

For Die Components, in the event of any failure, the complete Packaged Test Sublot may be tested.

8.1.3 Parameter Drift Values

At each of the relevant data points during Screening Tests (Charts F3A and F3B), Parameter Drift Values shall be measured as specified in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated.

8.1.4 Intermediate and End-Point Electrical Measurements

At each of the relevant data points during Qualification, Periodic Testing and Lot Validation Testing (Charts F4A and F4B), Intermediate and End-Point Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated if specified.

8.2 INTERNAL VISUAL INSPECTION AND DIE VISUAL INSPECTION

ESCC Basic Specification No. 20400.

8.3 SCANNING ELECTRON MICROSCOPE INSPECTION

ESCC Basic Specification No. 21400.

8.4 TOTAL DOSE RADIATION TESTING

ESCC Basic Specification No. 22900 to the total dose level specified in the Detail Specification or as stipulated in the Purchase Order.

8.5 BOND STRENGTH AND DIE SHEAR

8.5.1 Bond Strength
MIL-STD-750, Test Method 2037, Test Condition C or D.

Test Condition C shall only be permitted when Test Condition D cannot be used and never for bond wires of diameter less than 0.127mm.

- Test Samples:
  For Packaged Components during Special In-Process Controls (Chart F2), 3 test samples shall be selected at random from the lot of components accepted after Assembly and Internal Visual Inspection.

  For Packaged Components during Qualification, Periodic Testing and Lot Validation Testing (Chart F4A), all 6 test samples in the De-encapsulation Subgroup shall be selected

  For Die Components during Special In-Process Controls (Chart F2), 2 or 3 test samples as specified in Para. 5.3.1 shall be selected at random from the components of the Packaged Test Sublot accepted after Assembly and Internal Visual Inspection.

  For Die Components during Qualification, Periodic Testing and Lot Validation Testing (Chart F4B), all 4 Packaged Test Sublot samples in the De-encapsulation Subgroup shall be selected.

If agreed by the ESCC Executive (for qualification or qualification maintenance) or the Orderer (for procurement), the test samples for Special In-Process Controls may have only passed the low magnification phase of the Internal Visual Inspection.

Individual separation forces and categories shall be recorded. A single failure shall be cause for lot failure.

8.5.2 Die Shear
MIL-STD-750, Test Method 2017.

For Special In-Process Controls, test samples shall be selected at random from the lot of components accepted after Assembly and Internal Visual Inspection.

For Packaged Components, 3 test samples shall be selected. For Die Components, 2 or 3 test samples, as specified in Para. 5.3.1, shall be selected. The same test samples submitted to Bond Strength may be used.

If agreed by the ESCC Executive (for qualification or qualification maintenance) or the Orderer (for procurement), the test samples for Special In-Process Controls may have only passed the low magnification phase of the Internal Visual Inspection.

Individual separation forces and categories shall be recorded. A single failure shall be cause for lot failure.

When Die Shear is impractical, the components shall be subjected to a suitable alternate test as specified in the Detail Specification.

8.6 EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK

External Visual Inspection shall be performed in accordance with ESCC Basic Specification No. 20500.

Dimension Check (during Special In-Process Controls only) shall be performed in accordance with ESCC Basic Specification No. 20500 and the Detail Specification on a sample of 3 components. In the event of any failure, a 100% Dimension Check shall be performed.

8.7 HIGH TEMPERATURE STABILISATION BAKE

MIL-STD-750, Test Method 1032, Duration: 24 hours at maximum storage temperature rating specified in the Detail Specification.

8.8 TEMPERATURE CYCLING

8.8.1 Screening Tests (Chart F3A)

MIL-STD-750, Test Method 1051, Test Condition C, 20 cycles at maximum storage temperature rating specified in the Detail Specification.

8.8.2 Qualification, Periodic Testing and Lot Validation Testing (Chart F4A)

MIL-STD-750, Test Method 1051, Test Condition C, 100 cycles at maximum storage temperature rating specified in the Detail Specification.

8.9 PARTICLE IMPACT NOISE DETECTION (PIND)

MIL-STD-750, Test Method 2052, Test Condition A. The use of the same attachment medium for the Sensitivity Test Unit (STU) and for the components under test (DUT) is not mandatory.

PIND prescreening shall not be performed.

The test frequency shall be selected based on the average internal package height from the formula given in the test method. The average internal package height shall be the distance measured from the floor of the package cavity, excluding the thickness of the die mounted inside the package, to the underside of the package lid. Unless otherwise specified, for heights of less than 23mils, the test frequency shall be 130Hz, and for heights greater than 250mils, the test frequency shall be 40Hz.

The lot shall be submitted to the PIND test cycle a maximum of 5 times. After each PIND test cycle, defective devices shall be removed from the lot.

For Packaged Components, if the cumulative defective devices exceed 25% of the lot, the lot shall be rejected. For Die Components, if the cumulative defective devices exceed 25% of the lot, the Packaged Test Sublot shall be rejected.

After any of the 5 PIND test cycles, if the number of defective devices does not exceed 1 or is less than 1% of the number of devices submitted to the cycle, the lot shall be accepted.

8.10 BURN-IN 1

Diodes: MIL-STD-750, Test Method 1038, Test Condition A or B.

Transistors: MIL-STD-750, Test Method 1039, Test Condition A or B.

All other Devices: The test method shall be as specified in the Detail Specification.

- Duration and Test Conditions:
  As specified in Burn-in 1 in the Detail Specification. Unless otherwise specified, the duration shall be 48 hours minimum.
- Data Points:
  As specified in Parameter Drift Values in the Detail Specification at 0 hours (initial) and T (+48 -0) hours (where T is the specified duration). Drift shall be related to the initial measurement for Burn-in 1.

8.11 BURN-IN 2

Diodes: MIL-STD-750, Test Method 1038, Test Condition A or B.

Transistors: MIL-STD-750, Test Method 1039, Test Condition A or B.

All other Devices: The test method shall be as specified in the Detail Specification.

- Duration and Test Conditions:
  As specified in Burn-in 2 in the Detail Specification. Unless otherwise specified, the duration shall be 240 hours minimum.
- Data Points:
  As specified in Parameter Drift Values in the Detail Specification at T (+48 -0) hours (where T is the specified duration).
  If Burn-in 1 is not being performed, the 0 hours (initial) measurement is also required. Drift shall be related to the initial measurement for Burn-in 2.

8.12 RADIOGRAPHIC INSPECTION

ESCC Basic Specification No. 20900.

8.13 SEAL

8.13.1 Seal, Fine Leak

MIL-STD-750, Test Method 1071, Condition H1 or H2.

For components with a cavity ≤ 0.001cm$^3$, Condition H2 shall apply with a maximum leak rate of 1 x 10$^{-8}$atm.cm$^3$/s.

8.13.2 Seal, Gross Leak

MIL-STD-750, Test Method 1071, Condition C or K for components with cavities.

8.14 MECHANICAL SHOCK

MIL-STD-750, Test Method 2016, 1500g, 0.5ms duration, 5 shocks, planes X1, Y1 and Z1.

8.15 VIBRATION
MIL-STD-750, Test Method 2056, 20g, 10-2000Hz, cross over at 50Hz.

8.16 CONSTANT ACCELERATION
MIL-STD-750, Test Method 2006, 20000g, planes X1, Y1 and Y2.

8.17 MOISTURE RESISTANCE
MIL-STD-750, Test Method 1021.

8.18 OPERATING LIFE
MIL-STD-750, Test Method 1026. The test method shall be as specified in the Detail Specification.

- Duration:
  - 2000 hours minimum for Qualification Testing.
  - 1000 hours minimum for Periodic Testing.
- Conditions: As specified in Operating Life in the Detail Specification.
- Data Points:
  As specified in Intermediate and End-Point Electrical Measurements in the Detail Specification at 0 hours, 1000 (+96 -0) hours and 2000 (+96 -0) hours (as applicable). If drift values are specified, the drift shall always be related to the 0-hour measurement.

8.19 SOLDERABILITY
MIL-STD-750, Test Method 2026, to be performed on all terminals.

For components with gold plated lead finish, activated fluxes (RMA, RA and OA) may be used but shall be immediately cleaned off after dipping, using an acceptable solvent.

8.20 PERMANENCE OF MARKING
ESCC Basic Specification No. 24800.

8.21 TERMINAL STRENGTH
MIL-STD-750, Test Method 2036. Test Condition as specified in the Detail Specification.

## 9 DATA DOCUMENTATION

9.1 GENERAL

For the qualification, qualification maintenance and procurement for each lot, a data documentation package shall exist in a printed or electronic form.

This package shall be compiled from:

(a) Cover sheet (or sheets).
(b) List of equipment (testing and measuring).
(c) List of test references.
(d) Wafer Lot Acceptance data (Chart F2).
(e) Special In-Process Controls data (Chart F2).
(f) Screening Tests data (Charts F3A and F3B).
(g) Qualification, Periodic Testing and Lot Validation Testing (when applicable) data (Charts F4A and F4B).
(h) Failed components list and failure analysis report (when applicable).
(i) Certificate of Conformity.

Items (a) to (i) inclusive shall be grouped, preferably as subpackages and, for identification purposes, each page shall include the following information:

- ESCC Component Number.
- Manufacturer's name.
- Lot identification.
- Date of establishment of the document.
- Page number.

Whenever possible, documentation should preferably be available in electronic format suitable for reading using a compatible PC. The format supplied shall be legible, durable and indexed. The preferred storage medium is CD-ROM and the preferred file format is PDF.

9.1.1 Qualification and Qualification Maintenance

In the case of qualification or qualification maintenance, the items listed in Para. 9.1(a) to (i) are required.

9.1.2 Component Procurement and Delivery

For all deliveries of components procured to this specification, the following documentation shall be supplied:

(a) Cover sheet (if all of the information is not included on the Certificate of Conformity).
(b) Certificate of Conformity (including range of delivered serial numbers for Packaged Components or wafer and wafer lot numbers for Die Components).

9.1.3 Additional Documentation

The Manufacturer shall deliver additional documentation containing data and reports to the Orderer, if stipulated in the Purchase Order.

9.1.4 Data Retention/Data Access

If not delivered, all data shall be retained by the Manufacturer for a minimum of 5 years during which time it shall be available for review, if requested, by the Orderer or the ESCC Executive (for qualified components).

9.2 COVER SHEET(S)

The cover sheet(s) of the data documentation package shall include as a minimum:

(a) Reference to the Detail Specification, including issue and date.
(b) Reference to the applicable ESCC Generic Specification, including issue and date.
(c) ESCC Component Number and the Manufacturer's part type number.
(d) Lot identification (including wafer and wafer lot number for Die Components).
(e) Range of delivered serial numbers (for Packaged Components).
(f) Number of the Purchase Order.
(g) Total dose radiation test level (if applicable).
(h) Information relative to any additions to this specification and/or the Detail Specification.
(i) Manufacturer's name and address.
(j) Location of the manufacturing plant (specify place of diffusion, assembly and test).
(k) Signature on behalf of Manufacturer.
(l) Total number of pages of the data package.

9.3 LIST OF EQUIPMENT USED

A list of equipment used for tests and measurements shall be prepared. Where applicable, this list shall contain inventory number, Manufacturer's type number, serial number, etc. This list shall indicate for which tests such equipment was used.

9.4 LIST OF TEST REFERENCES

This list shall include all Manufacturer's references or codes which are necessary to correlate the test data provided with the applicable tests specified in the tables of the Detail Specification.

9.5 WAFER LOT ACCEPTANCE DATA (CHART F2)

For Die Components, a test result summary shall be compiled giving the total number of dice and wafers submitted to and the total number of dice and wafers rejected after each of the tests. For each test requiring electrical measurements, the results shall be traceable to wafer and wafer lot.

Data of SEM Inspection shall be prepared in accordance with the requirements of ESCC Basic Specification No. 21400.

A total dose radiation test report shall be prepared in accordance with the requirements of ESCC Basic Specification No. 22900 (if specified).

9.6 SPECIAL IN-PROCESS CONTROLS DATA (CHART F2)

A test result summary shall be compiled showing the total number of components submitted to, and the total number rejected after each of the tests. For Die Components, a list of wafer and wafer lot numbers versus serial number shall be compiled for the Packaged Test Sublot. For the Bond Strength and Die Shear tests, the separation forces and categories shall be recorded.

9.7 SCREENING TESTS DATA (CHARTS F3A AND F3B)

A test result summary shall be compiled showing the total number of components submitted to and the total number rejected after each of the tests. Unless otherwise specified, for each test requiring electrical measurements the results shall be recorded against component serial number. Component drift calculations shall be recorded for each specified test against component serial number. For Radiographic Inspection, photographic results shall be recorded against component serial number.

9.8 QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING DATA (CHARTS F4A AND F4B)

9.8.1 Qualification Testing

A test result summary shall be compiled showing the components submitted to, and the number rejected after each test in each subgroup. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

9.8.2 Periodic Testing for Qualification Maintenance

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

In addition to the full test data a report shall be compiled for each subgroup of Chart F4A or F4B (as applicable) to act as the most recent Periodic Testing summary. These reports shall include a list of all tests performed in each subgroup, the ESCC Component Numbers and quantities of components tested, a statement confirming all the results were satisfactory, the date the tests were performed and a reference to the full test data.

9.8.3 Lot Validation Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup (as applicable). Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test the drift calculation shall be recorded against component serial number.

9.9 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

The failed components list and failure analysis report shall provide full details of:

(a) The reference and description of the test or measurement performed as defined in this specification and/or the Detail Specification during Wafer Lot Acceptance, Special In-Process Controls, Screening Tests, and Qualification, Periodic Testing and Lot Validation Testing.
(b) Traceability information including wafer, wafer lot and serial number (if applicable) of the failed component.
(c) The failed parameter and the failure mode of the component.
(d) Detailed failure analysis (if requested by the ESCC Executive or Orderer).

9.10 CERTIFICATE OF CONFORMITY

A Certificate of Conformity shall be established in accordance with the requirements of ESCC Basic Specification No. 20100 or 25400.

## 10 DELIVERY

For procurement, for each order, the items forming the delivery are:

(a) The delivery lot.
(b) The components used for Lot Validation Testing (as applicable), but not forming part of the delivery lot, if stipulated in the Purchase Order.
(c) The relevant documentation in accordance with the requirements of Paras. 9.1.2 and 9.1.3.

**NOTE:** Except for qualification or qualification maintenance of Die Components, the Packaged Test Sublot samples may be delivered if so stipulated in the Purchase Order.

In the case of a component for which a valid qualification is in force, all data of all components submitted to Lot Validation Testing shall also be copied, when requested, to the ESCC Executive.

For qualification or qualification maintenance, the disposition of the Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification Nos. 20100 or 25400 and the relevant paragraphs of Section 9 of this specification.

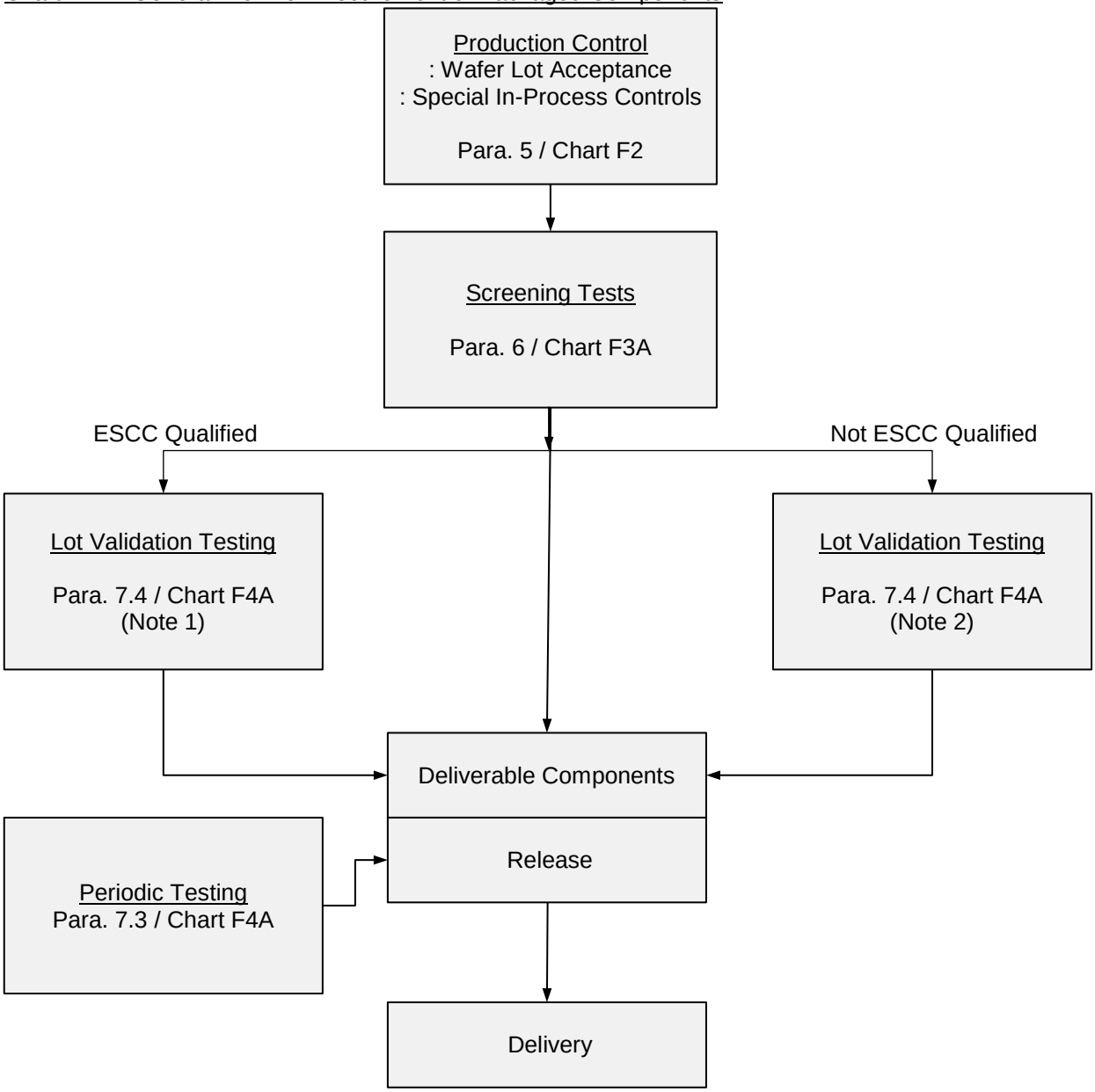
## 11 PACKAGING AND DISPATCH

The packaging and dispatch of components to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 20600.

## 12 CHARTS

### 12.1 CHART F1 - GENERAL FLOW FOR PROCUREMENT

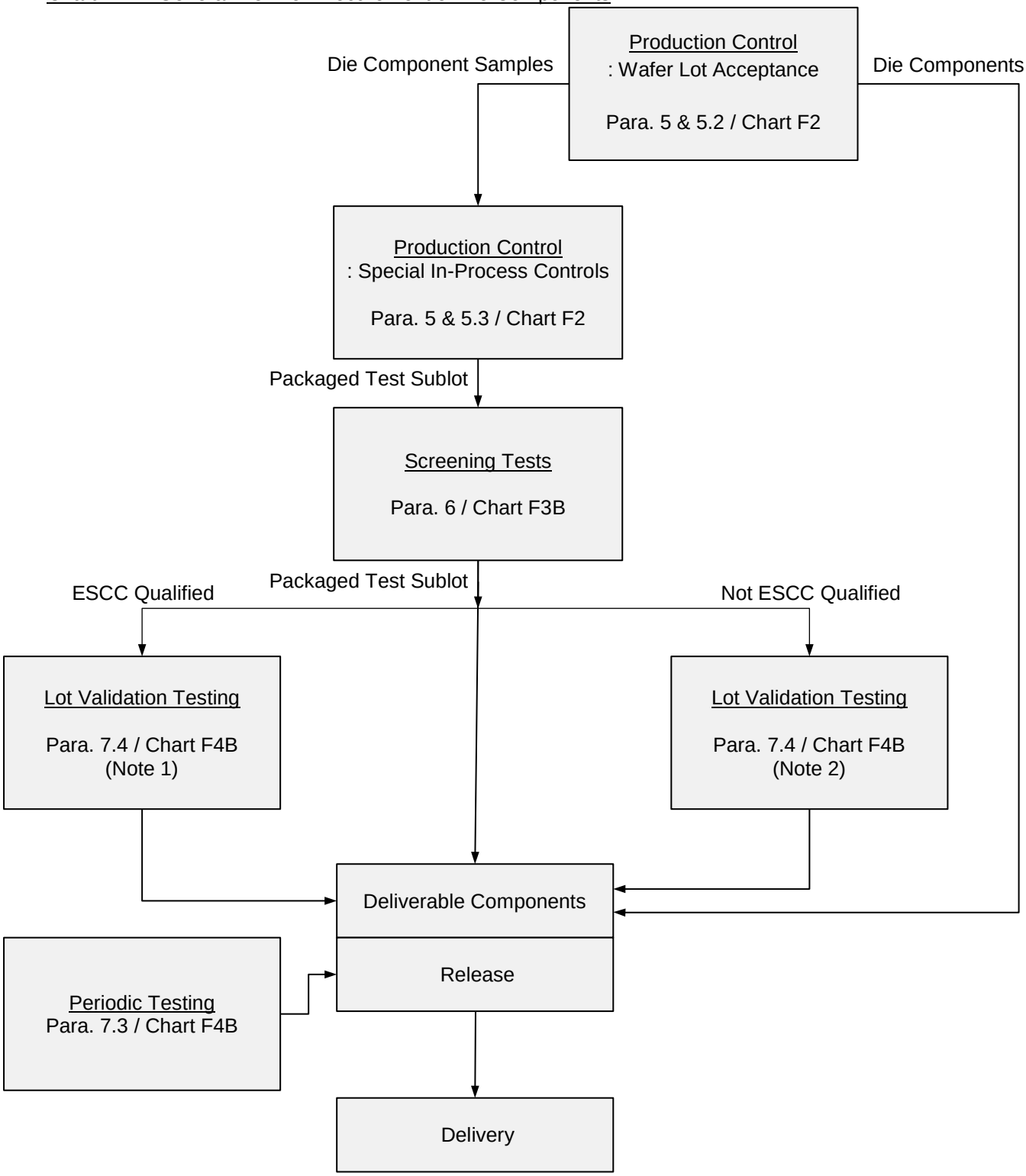
#### 12.1.1 Chart F1A - General Flow for Procurement of Packaged Components




**NOTES:**

1. Lot Validation Testing is not required for qualified Packaged Components unless specifically stipulated in the Purchase Order.
2. For unqualified Packaged Components, the need for Lot Validation Testing shall be determined by the Orderer and the required testing shall be as stipulated in the Purchase Order (Ref. ESCC Basic Specification No. 23100).

12.1.2 Chart F1B - General Flow for Procurement of Die Components




**NOTES:**

1. Lot Validation Testing is not required for qualified Die Components unless specifically stipulated in the Purchase Order.
2. For unqualified Die Components, the need for Lot Validation Testing shall be determined by the Orderer and the required testing shall be as stipulated in the Purchase Order (Ref. ESCC Basic Specification No. 23100).

12.2 CHART F2 - PRODUCTION CONTROL

| COMPONENT LOT MANUFACTURING | |
|---|---|
| **WAFER LOT ACCEPTANCE** | |
| Para. 5.2.1 | Process Monitoring Review |
| Para. 5.2.2(a) | Room Temperature Electrical Measurements (Wafer Screening) (1) (2) |
| Para. 5.2.2(b) | High and Low Temperature Electrical Measurements (Wafer Screening) (1) (2) (3) |
| - | Wafer Dicing |
| Para. 5.2.2(c) | Die Visual Inspection (Wafer Screening) (2) |
| Para. 5.2.3 | Die Dimensions (2) (4) |
| Para. 5.2.4 | SEM Inspection (3) |
| Para. 5.2.5 | Total Dose Radiation Testing (3) (5) |
| **SPECIAL IN-PROCESS CONTROLS** | |
| - | Assembly (6) |
| Para. 5.3.2 | Internal Visual Inspection |
| Para. 5.3.3 | Bond Strength (3) |
| Para. 5.3.3 | Die Shear (3) |
| - | Encapsulation |
| Para. 5.3.4 | Dimension Check (3) (7) |
| Para. 5.3.5 | Weight (4) (7) |
| TO CHART F3A OR F3B – SCREENING TESTS | |

**NOTES:**

1. May be performed either as an on-wafer measurement or after dice separation.
2. Only required for Die Components.
3. Performed on a sample basis.
4. Guaranteed but not tested.
5. Only required if specified in the Detail Specification and stipulated in the Purchase Order.
6. Assembly of the production lot for Packaged Components or the Packaged Test Sublot samples for Die Components (see Para. 5.3.1).
7. Only applicable to Packaged Components; Not applicable to the Packaged Test Sublot samples for Die Component.

12.3 CHART F3 - SCREENING TESTS

12.3.1 Chart F3A - Screening Tests for Packaged Components

| PACKAGED COMPONENTS FROM PRODUCTION CONTROL | |
|---|---|
| Para. 8.7 | High Temperature Stabilisation Bake |
| Para. 8.8.1 | Temperature Cycling |
| Para. 8.9 | Particle Impact Noise Detection (PIND) (1) |
| Para. 8.1.1.2 | Room Temperature Electrical Measurements (2) |
| Para. 6.1 | Serialisation (3) |
| Para. 8.1.3 | Parameter Drift Values (Initial Measurements) (4) |
| Para. 8.10 | Burn-in 1 |
| Para. 8.1.3 | Parameter Drift Values Δ1 (Final Measurements for Burn-in 1; Initial Measurements for Burn-in 2) (5) |
| Para. 6.4.1 | Check for Lot Failure for Burn-in 1<br>(PDA1 = 5%) (6) |
| Para. 8.11 | Burn-in 2 |
| Para. 8.1.3 | Parameter Drift Values Δ2 (Final Measurements) (5) |
| Para. 6.4.1 | Check for Lot Failure for Burn-in 2<br>(PDA2 = 5%) (7) |
| Para. 8.1.2.2 | High and Low Temperatures Electrical Measurements (5) (8) |
| - | Hot Solder Dip (if applicable) (9) |
| Para. 8.1.1.2 | Room Temperature Electrical Measurements (5) (10) |
| Para. 6.4.1 | Check for Lot Failure for Screening Tests<br>(PDA3 = 10%) (11) |
| Para. 8.12 | Radiographic Inspection (12) |
| Para. 8.13 | Seal (Fine and Gross Leak) |
| Para. 8.6 | External Visual Inspection |
| TO CHART F4A WHEN APPLICABLE | |

**NOTES:**

1. Only applicable to components with cavities.
2. Test is optional at the Manufacturer's discretion (Go-no-go test; recording of results is also optional at the Manufacturer's discretion).
3. Serialisation made be performed at any point prior to initial measurements of Parameter Drift Values.
4. Measurements need not be repeated if data is available from the previous Room Temperature Electrical Measurements.
5. The lot failure criteria of Para. 6.4.1 apply to this test.
6. PDA1 Check for Lot Failure shall take into account all electrical parameter failures that may occur during Parameter Drift Values (Δ1) in accordance with Para. 8.1.3 after Burn-in 1.
7. PDA2 Check for Lot Failure shall take into account all electrical parameter failures that may occur during Parameter Drift Values (Δ2) in accordance with Para. 8.1.3 after Burn-in 2.
8. Performed on a sample basis.

9. For components with hot solder dip final lead finish, the hot solder dip processing shall be performed at any time prior to Room Temperature Electrical Measurements during Screening Tests. The requirements for hot solder dip are specified in ESCC Basic Specification No. 23500.
10. Measurements of Parameter Drift Values need not be repeated in Room Temperature Electrical Measurements.
11. PDA3 Check for Lot Failure shall take into account all electrical parameter failures that may occur during Screening Tests in accordance with Para. 8.1.1.2, 8.1.2.2 and 8.1.3 at any point subsequent to Burn-in 1.
12. Radiographic Inspection may be performed at any point during Screening Tests after Serialisation.

12.3.2 Chart F3B - Screening Tests for Die Components

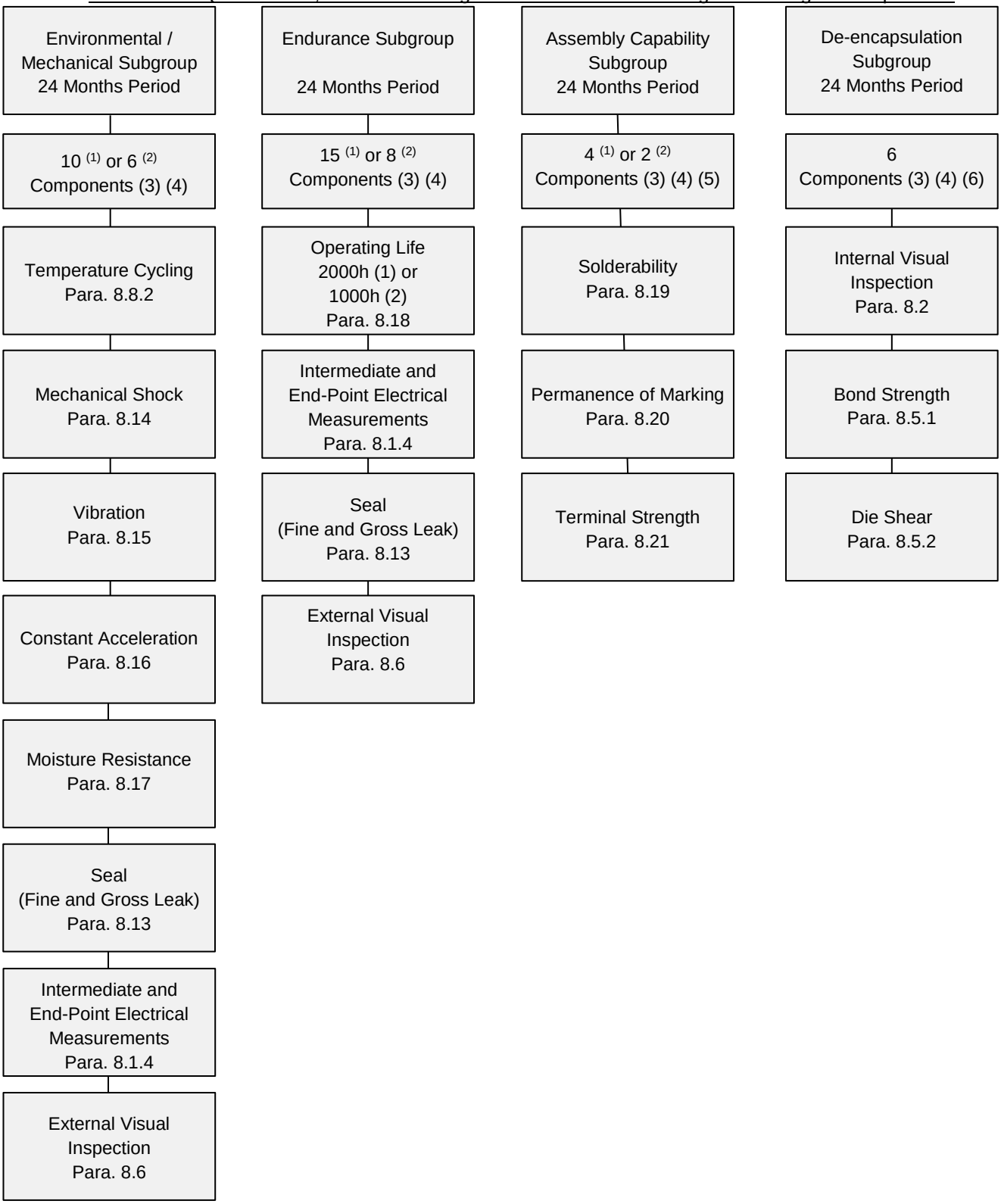
| PACKAGED COMPONENTS FROM PRODUCTION CONTROL | |
|---|---|
| Para. 6.1 | Serialisation |
| Para. 8.1.1.2 | Room Temperature Electrical Measurements (1) (2) |
| Para. 8.1.2.2 | High and Low Temperatures Electrical Measurements (1) (2) (3) (4) |
| Para. 6.4.2.1 | Check for Lot Failure<br>(PDA0 = 10%) (5) |
| Para. 8.1.3 | Parameter Drift Values (Initial Measurements) (2) (6) |
| Para. 8.10 | Burn-in 1 |
| Para. 8.1.3 | Parameter Drift Values Δ1 (Final Measurements for Burn-in 1; Initial Measurements for Burn-in 2) (2) |
| Para. 6.4.2.2 | Check for Lot Failure for Burn-in 1<br>(PDA1 = 5%) (7) |
| Para. 8.11 | Burn-in 2 |
| Para. 8.1.3 | Parameter Drift Values Δ2 (Final Measurements) (2) |
| Para. 6.4.2.2 | Check for Lot Failure for Burn-in 2<br>(PDA2 = 5%) (8) |
| Para. 8.1.2.2 | High and Low Temperatures Electrical Measurements (2) (3) |
| Para. 8.1.1.2 | Room Temperature Electrical Measurements (2) (9) |
| Para. 6.4.2.2 | Check for Lot Failure for Screening Tests<br>(PDA3 = 10%) (10) |
| TO CHART F4A WHEN APPLICABLE | |

**NOTES:**

1. The lot failure criteria of Para. 6.4.2.1 apply to this test.
2. The lot failure criteria of Para. 6.4.2.2 apply to this test.
3. Performed on a sample basis.
4. Optional at the Manufacturer's discretion.
5. PDA0 Check for Lot Failure shall take into account all electrical parameter failures that may occur during Screening Tests in accordance with Para. 8.1.1.2 and 8.1.2.2 prior to this check.
6. Measurements of Parameter Drift Values need not be repeated if data is available from the previous Room Temperature Electrical Measurements.
7. PDA1 Check for Lot Failure shall take into account all electrical parameter failures that may occur during Parameter Drift Values (Δ1) in accordance with Para. 8.1.3 after Burn-in 1.
8. PDA2 Check for Lot Failure shall take into account all electrical parameter failures that may occur during Parameter Drift Values (Δ2) in accordance with Para. 8.1.3 after Burn-in 2.
9. Measurements of Parameter Drift Values need not be repeated in Room Temperature Electrical Measurements.
10. PDA3 Check for Lot Failure shall take into account all electrical parameter failures that may occur at any point during Screening Tests in accordance with Para. 8.1.1.2, 8.1.2.2 and 8.1.3.

12.4 CHART F4 - QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING

12.4.1 Chart F4A – Qualification, Periodic Testing and Lot Validation Testing for Packaged Components



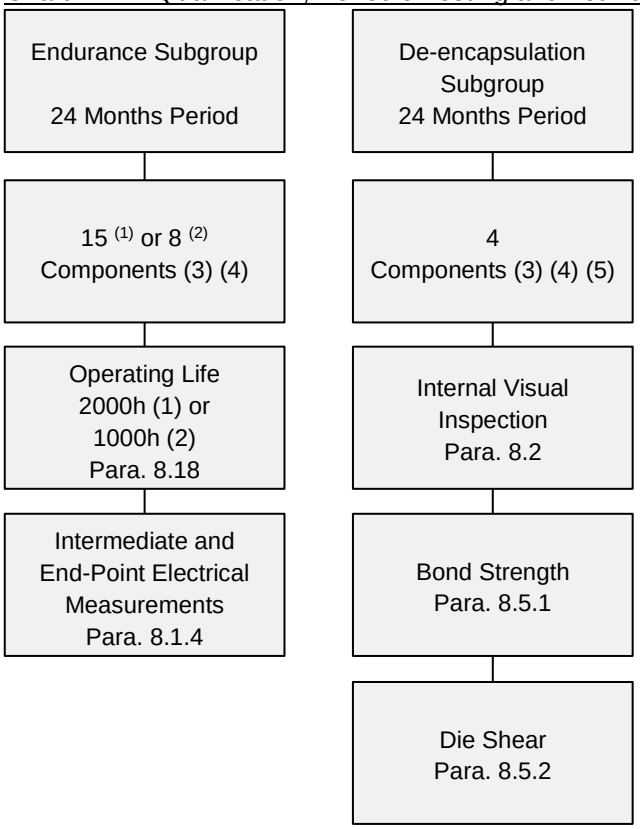

**NOTES:**

1. Applicable to Qualification Testing.
2. Applicable to Periodic Testing

3. For distribution within the subgroups, see Para. 7.1.2 for Qualification Testing and Periodic Testing, and Para. 7.4 for Lot Validation Testing.
4. No failures are permitted.
5. The Assembly Capability Subgroup tests may be performed on empty packages or electrical rejects. The test samples used must be of the same package type and must have been manufactured using the same process, at the same time and have been subjected to the same screening as the packages of the assembly lot with which they are associated.
6. The samples for the De-encapsulation Subgroup shall be selected as follows:
   - 2 components which have successfully passed the tests in Chart F3A
   - 2 components which have successfully passed the Environmental / Mechanical Subgroup testing of Chart F4A
   - 2 components which have successfully passed the Endurance Subgroup testing of Chart F4A

   The components shall be de-encapsulated using suitable means to facilitate Internal Visual Inspection, Bond Strength and Die Shear.

12.4.2 Chart F4B – Qualification, Periodic Testing and Lot Validation Testing for Die Components




**NOTES:**

1. Applicable to Qualification Testing (on Packaged Test Sublot samples).
2. Applicable to Periodic Testing (on Packaged Test Sublot samples).
3. For distribution within the subgroups, see Para. 7.1.2 for Qualification Testing and Periodic Testing, and Para. 7.4 for Lot Validation Testing.
4. No failures are permitted.
5. The samples for the De-encapsulation Subgroup shall be selected as follows:
   - 2 components which have successfully passed the tests in Chart F3B.
   - 2 components which have successfully passed the Endurance Subgroup testing of Chart F4B.

   The components shall be de-encapsulated using suitable means to facilitate Internal Visual Inspection, Bond Strength and Die Shear.