REVISIONS

REV.	ECO NO.	DESCRIPTION OF UPDATE	APPROVED	DATE
-	RLSD	N/A	D. MILLER	02/87
A	1481	Per ECO	D. MILLER	08/88
B	2054	Per ECO	D. MILLER	12/90
C	2203	Per ECO	C. HEISELMAN	03/91
D	3183	Per ECO	C. HEISELMAN	12/08/92
E	5227	Per ECO	C. HEISELMAN	07/10/96
F	6716	Per ECO	C. HEISELMAN	04/16/98
G	9581	Per ECO	C. HEISELMAN	12/27/01
H	10824	Per ECO	C. HEISELMAN	03/19/03
J	11715	Per ECO	C. HEISELMAN	07/11/04
K	13372	Per ECO	C. HEISELMAN	03/23/06
L	16865	Add 4.1.3 flow down to subtier	C. HEISELMAN	01/21/10
M	20757	Add 4.1.10 Requirements for record retention	C. HEISELMAN	01/03/14
N	176066	Tie in Anaren Doc. #81000, general clarification, remove redundant information now located in 81000.	B. HAHN	02/27/15
P	183404	Add gel pak option, remove test sample delivery for Condition E	B. HAHN	02/22/16
R	197543	Add "Space Data Package" to "Test data"	B. HAHN	07/27/17
T	205458	Add waffle pack specifications	B. HAHN	06/06/18
U	209822	Add packaging requirements and update document	J. DOUGLAS	09/10/18
V	210539	Add "NO STACK" requirement to packaging	[signature]	10/18/18

Anaren Proprietary: This document includes proprietary data of Anaren Microwave, Inc. and shall not be duplicated or disclosed in whole or in part to any third party, and shall not be duplicated, used, or disclosed for any purpose without the express written permission of Anaren.

DO NOT SCALE DRAWING	APPROVALS		Anaren® A TTM Technologies COMPANY			DISTRIBUTION DATE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS ± - DECIMALS ± - ± - ANGLE ± -	DRAFTER J. VANDEUSEN	DATE 10/02/18	TITLE PROCUREMENT SPECIFICATION FOR MICROCIRCUIT / SEMICONDUCTOR			
	DRAFTING CHECK N. Kusse	DATE 10-12-18				
MATERIAL N/A	ENGINEERING CHECK Daniel Dearwards	DATE 10-15-18				
FINISH N/A	QUALITY ASSURANCE [signature]	DATE 10-15-18	DRAWING NO. 1019-1618	REV. V	SHEET 1 OF 7	DEPARTMENT

1.0 PURPOSE:

The purpose of this document is to define the supplier requirements of all procured microcircuit elements (Integrated Circuits) and semiconductor elements (diodes, transistor, etc.) used in devices. This document is used in conjunction with Anaren Document #81000.

2.0 APPLICATION:

This procedure shall apply to all microcircuit elements and semiconductors as follows:

2.1 **Condition A** - Elements to be used in compliance with MIL-PRF-38534 Class H devices. Element evaluation shall be performed IAW MIL-PRF-38534 Class H and data provided with delivery. Note 1.

2.2 **Condition B** - Elements intended to be used in full compliance with MIL-PRF-38534 Class H but element evaluation will be the responsibility of the user. Supplier/Mfg is responsible for 100% visual and electrical. Note 1.

2.3 **Condition C** - Elements to be used on devices which do not impose MIL-PRF-38534 element evaluation.

2.4 **Condition D** - Elements to be used in compliance with MIL-PRF-38534 Class K devices. Element evaluation shall be performed IAW MIL-PRF-38534 Class K and data provided with delivery. Note 2.

2.5 **Condition E** - Elements tested IAW the element drawing. When specified on the PO, 12 die shall be packaged and shipped to the user for Radiation Testing. Note 2.

NOTE 1 ***For Class H devices, element evaluation testing is not required for JANHC or JANKC discrete semiconductor which have been tested in accordance with MIL-PRF-19500, or if the microcircuit die are MIL-PRF-38535 Class Q or V qualified. (Class Q is equivalent to Hybrid Class H and Class V is equivalent to Hybrid Class K)***

NOTE 2 ***For Class K devices, element evaluation testing is not required for JANKC discrete semiconductor which have been tested in accordance with MIL-PRF-19500, or if the microcircuit die are MIL-PRF-38535 Class V qualified (Class V is equivalent to Hybrid Class K)***

3.0 DEFINITIONS:

3.1 **Element** - A constituent of the hybrid microcircuit that contributes directly to its operation. The element shall be coated, except bonding pads, with an approved transparent glass to a minimum thickness of 200 nm of Si_3N_4 or equivalent.

3.2 **Microcircuit** - A small active circuit having a high equivalent circuit element density, which is considered as a single part composed of interconnected elements on one or more substrates to perform an electronic circuit function. The microcircuit shall be coated with a transparent glass or other approved coating to a minimum thickness of 600nm for SiO_2 and 200nm for Si_3N_4 and shall cover all conductors except bonding pads.

Internal thin film conductors on a substrate (metallization stripes, contact areas, bonding interfaces, etc.) shall be designed so that no properly fabricated conductor shall experience in normal operation (at worst case specified operating conditions), a current density in excess of the maximum allowable value shown below for the applicable conductor material:

Conductor Material	Maximum Allowable Current Density
Aluminum (99.99 percent pure or doped) without glassivation.	2×10^5 A/cm^2
Aluminum (99.99 percent pure or doped) glassivated.	5×10^5 A/cm^2
Gold	6×10^5 A/cm^2
All other (unless otherwise specified)	2×10^5 A/cm^2

The current density shall be calculated at the point of maximum current density (ie. greatest current per unit cross section) for the specified device type and schematic or configuration.

3.3 **Wafer Lot** - Wafer lots consist of microcircuit and semiconductor wafers formed into lots at the start of wafer fabrication for homogeneous processing as a group. Each lot is assigned a unique identifier or code to provide traceability and maintain lot integrity throughout the fabrication process. Wafer lot processing as a homogeneous group is accomplished by any of the following procedures, providing process schedules and controls are sufficiently maintained, to assure identical processing in accordance with process instructions of all wafers in the lot:

a. Batch processing of all wafers in the wafer lot through the same machine process steps simultaneously.

b. Continuous or sequential processing (wafer by wafer or batch portions of wafer lot) of all wafers through the same machine or process steps.

c. Parallel processing of portions of the wafer lot through multiple machines or process stations on the same certified line, provided statistical quality control (SQC) assures and demonstrates correlation between stations and separately processed portions of the wafer lot.

3.4 **Production Lot -** A production lot consists of a device type manufactured from the same basic raw materials on the same production line, processed under the same manufacturing techniques and controls using the same type of equipment. Each lot shall be assigned a unique identification that provides traceability to all processing steps.

3.5 **Inspection Lot** - An inspection lot shall consist of microcircuits/semiconductors of a single circuit type submitted at one time for inspection to determine compliance with the applicable requirements and acceptable criteria.

3.6 **Element Evaluation** - As applicable to this specification shall consist of Microcircuit/Semiconductor die evaluated IAW MIL-PRF-38534.

3.7 **Environmentally Controlled Area** - An area which exhibits the following conditions:

3.7.1 Temperature shall be 25°C (+3/-5°C)

3.7.2 Class 8 per ISO 14644-1, -2 or Class 100,000 per MIL-STD-209

3.7.3 Humidity - RH 30 to 65%

3.7.4 Positive Pressure .01” water column or greater

3.7.5 Element Storage shall be in a nitrogen atmosphere dry box.

4.0 REQUIREMENTS:

4.1 General:

4.1.1 All material and processes used by die processor will be suitable for polymeric adhesive, soldering and/or eutectic die mounting. As applicable to the element design, pad metallization shall be suitable for thermosonic, ultrasonic and/or thermo compression bonding of gold or aluminum wire and shall be capable of withstanding a pull test as specified per MIL-STD-883, Method 2011.

4.1.2 All electrical test (100%) and visual inspection (100%) may be done at the wafer level provided all rejects are identified and removed from the lot when dice are separated from the wafer.

4.2 Packaging Requirements:

4.2.1 Packaging:

Refer to element packaging Table 1.

Elements shall be packaged to prevent damage during shipment and for automated assembly.

4.2.2 Package Marking:

The element part number, manufacturer's name, manufacturer's lot number and quantity shall appear on each waffle tray/gel pack. All samples and test data shall be identified by its device type, manufacturer's name and manufacturer's lot number. Markings shall be sufficient for inspection lot traceability.

4.2.3 Certificate of Compliance:

As defined in document #81000.

Element Packaging Requirements Table 1

Element Type		Packaging Requirement		
Semiconductor elements (transistor and diode dice)		2" x 2" black conductive waffle tray with: - carrier well must be deep enough so that the die surface is below the top plane of the waffle tray - protective sheet or pad - secure lid (hinge or clamp) - No stacking of waffle packs. Single clip required.	OR	2" x 2" black conductive gel pack with vacuum release for auto pick and place capability: - secure lid (hinge or clamp) - No stacking of waffle packs. Single clip required.
Microcircuit elements (integrated circuit dice)	Without air bridges	2" x 2" black conductive waffle tray with: - carrier well must be deep enough so that the die surface is below the top plane of the waffle tray - protective sheet or pad - secure lid (hinge or clamp) - No stacking of waffle packs. Single clip required.	OR	2" x 2" black conductive gel pack with vacuum release for auto pick and place capability: - secure lid (hinge or clamp) - No stacking of waffle packs. Single clip required.
	With air bridges	ONLY		2" x 2" black conductive gel pack with vacuum release for auto pick and place capability: - secure lid (hinge or clamp) - No stacking of waffle packs. Single clip required.
For elements which will not fit into a 2" x 2" waffle tray or gel pack		Elements shall be packaged in a manner that: 1. Physically restrained from vibration and mechanically isolated from shock that could cause physical damage or electrical degradation of the elements. 2. Sealed in an electrostatic bag.		

5.0 PROCEDURE:

5.1 **Condition A** - Supplier requirements for semiconductor elements (transistor and diode dice).

5.1.1 The supplier shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical data book and/or element drawing. Devices shall be capable of operating over full temperature range to minimum and maximum electrical data book specifications/element drawing.

5.1.2 The supplier shall have an accepted internal document for visual inspection to MIL-STD-750, Method 2069, 2070, 2072, 2073 as applicable.

5.1.3 The supplier shall perform 100% visual inspection to an in-house control document in an environmentally controlled area and ensure compliance to all visual and mechanical specifications.

5.1.4 Element evaluation shall be performed by the supplier for each production lot in accordance with MIL-PRF-38534 for Class H elements.

5.1.5 **Delivery Conditions:**

a. **Packaging** - Packaging shall be IAW section 4.2 Packaging Requirements.

b. **Marking** - The dice type, manufacturer's name, quantity and wafer lot number shall appear on each waffle pack. All samples and test data shall be identified by its device type, manufacturer's name and wafer lot number. Markings shall be sufficient for inspection lot traceability.

c. **Required Documentation** - Supplier performance data to be submitted with the inspection lot:
   1. Attributes Data
   2. Test Data

d. **Certificate of Compliance** as defined in Document #81000.

5.2 **Condition A** - Supplier requirements for microcircuit elements (integrated circuits).

5.2.1 The supplier shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical data book and/or element drawing. Devices shall be capable of operating over full temperature range to minimum and maximum electrical data book specifications/element drawing.

5.2.2 The supplier shall have an accepted internal document for visual inspection to MIL-STD-883 Method 2010 Condition B.

5.2.3 The supplier shall perform 100% visual inspection to an in-house approved control document in an environmentally controlled area and ensure compliance to all mechanical specifications.

5.2.4 Element evaluation shall be performed by the supplier on each wafer lot in accordance with MIL-PRF-38534 for Class H elements.

5.2.5 **Delivery Conditions:**

a. **Packaging** - Packaging shall be IAW section 4.2 Packaging Requirements.

b. **Marking** - The dice type, manufacturer's name, quantity and wafer lot number shall appear on each waffle pack. All samples and test data shall be identified by its device type, manufacturer's name and wafer lot number. Markings shall be sufficient for inspection lot traceability.

c. **Required Documentation** - Supplier performance data to be submitted with the inspection lot:
   1. Element Evaluation Data
   2. Test Data

d. **Certificate of Compliance** as defined in Document #81000.

5.3 **Condition B** - Supplier requirements of all semiconductor elements (transistors and diode dice) and microcircuit (integrated circuits).

5.3.1 The supplier shall have an accepted internal document for Visual Inspection to MIL-STD-883 Method 2010 Condition B or MIL-STD-750 Method 2069, 2070, 2072, 2073 as applicable. The supplier shall perform visual inspection 100% in an environmentally controlled area and ensure compliance to all mechanical specifications.

5.3.2 Each die shall be 100% electrically tested at 25°C to ensure compliance to the manufacturer's electrical database and/or element drawing. Devices shall be capable of operating over full temperature range to minimum and maximum electrical data book specifications.

5.3.3 Delivery conditions shall be in accordance with 5.1.5.

5.4 **<u>Condition C</u>** - Elements procured for element drawing.

5.4.1 The supplier shall perform 100% electrical testing at 25°C to manufacturers databook.

All electrical rejects shall be marked with solvent resistant ink.

Testing or grading for special electrical characteristics will be handled on an individual basis.

5.4.2 Devices shall be capable of meeting the visual requirements of MIL-STD-750 test method for semiconductor devices Method 2069, 2070, 2072, 2073 and MIL-STD-883 Method 2010 Condition B.

The contractor shall have a sample inspection performed on each wafer lot to assure conformance.

5.4.3 **<u>Preservation</u>**: - Packaging shall be IAW section 4.2 Packaging Requirements

5.4.4 **<u>Certificate of Compliance</u>** as defined in Document #81000.

5.5 **<u>Condition D and E</u> -** Supplier requirements for <u>semiconductor elements</u> (transistor and diode dice) and for <u>radiation</u> (as applicable) tested elements.

5.5.1 The supplier shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical characteristics and/or element drawing. Devices shall be capable of operating over full temperature range to minimum and maximum electrical data book specifications/element drawing.

5.5.2 The supplier shall have an accepted internal document for visual inspection to MIL-STD-883, Method 2069, 2070, 2072, 2073 as applicable.

5.5.3 The supplier shall perform 100% visual inspection to an in-house control document in an environmentally controlled areas (see 3.6) and ensure compliance to all mechanical specifications.

5.5.4 For Condition D Element evaluation shall be performed by the supplier for each wafer lot in accordance with MIL-PRF-38534 for Class K elements. <u>Test samples shall be delivered with each lot</u>.

For Condition E, Element evaluation shall be performed IAW the element drawing.

5.5.5 When specified on the purchase order, 12 die from the same lot shall be packaged and tested with recorded data. The packaged die shall be shipped prior to completion of Class K element evaluation. The 12 packaged die are above and beyond the Class K element evaluation and will be used for radiation testing.

5.5.6 **<u>Delivery Conditions:</u>**

a. **<u>Packaging</u> -** Packaging shall be IAW section 4.2 Packaging Requirements.

b. **<u>Marking</u> -** The die type, manufacturer's name, quantity and inspection lot number shall appear on each waffle pack. Markings shall be sufficient for inspection lot traceability.

c. **<u>Required Documentation</u> -** Supplier performance data to be submitted with the inspection lot:
   1. Element evaluation data.
   2. Test data (Space Data Package, as applicable)

d. **<u>Certificate of Compliance</u>** as defined in Document #81000.

5.6 **<u>Condition D and E</u> -** Supplier requirements for <u>microcircuit elements</u> (Integrated Circuits) and for <u>radiation</u> (as applicable) tested elements.

5.6.1 The supplier shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical characteristics and/or element drawing. Elements shall be capable of operating over full temperature range to minimum and maximum electrical data book specifications/element drawing.

5.6.2 The supplier shall have an accepted internal document for visual inspection to MIL-STD-883 Method 2010 Condition A.

5.6.3 The supplier shall perform 100% visual inspection to an in-house approved control document in an environmentally controlled area (See 3.6) and ensure compliance to all mechanical specifications.

5.6.4 For Condition D Element evaluation shall be performed by the supplier for each wafer lot in accordance with MIL-PRF-38534 for Class K elements. Test samples shall be delivered with each lot.

For Condition E Element evaluation shall be performed IAW the element drawing.

5.6.5 When specified on the purchase order, 12 die from the same lot shall be packaged and tested with recorded data. The packaged die shall be shipped prior to completion of Class K element evaluation. The 12 packaged die are above and beyond the Class K element evaluation and will be used for radiation testing.

5.6.6 **Delivery Conditions:**

a. **Packaging -** Packaging shall be IAW section 4.2 Packaging Requirements.

b. **Marking -** The die type, manufacturer's name, quantity and inspection lot number shall appear on each waffle pack. Markings shall be sufficient for inspection lot traceability.

c. **Required Documentation** - Supplier performance data to be submitted with the inspection lot:

1. Element evaluation data.
2. Test data (Space Data Package, as applicable)

d. **Certificate of Compliance** as defined in Document #81000.

6.0 ACCEPT/REJECT CRITERIA:

6.1 Accept all lots which pass the applicable paragraphs of this procedure and the element drawing.

6.2 Reject any device(s) and separate it from the lot which fails an electrical parameter or visual/mechanical criteria.

6.3 Reject any wafer lot which does not pass element evaluation or radiation testing.

7.0 QUALITY ASSURANCE PROVISIONS:

7.1 Anaren reserves the right to perform testing in accordance with paragraph 2.0 and any failure of the material to meet requirements of this document shall be cause for rejection.

7.2 Anaren reserves the right to review any suppliers program, process and data to assure conformance to the requirements of this specification, the purchase order and the element drawing.

8.0 REFERENCE DOCUMENTS:

8.1 MIL-STD-883

8.2 Element drawing.

8.3 Anaren purchase order.

8.4 MIL-STD-750

8.5 MIL-PRF-38534

8.6 MIL-PRF-19500

8.7 MIL-PRF-38535

8.8 ISO14644-1, -2 or MIL-STD-209

8.9 Anaren supplier requirements for Quality, Design & Manufacturing, Document #81000.