

1.0 PURPOSE:

The purpose of this document is to define the requirements for procurement of passive elements (resistors, resistor networks, thickfilm substrates, thinfilm substrates, inductors, transformers and capacitors) used for hybrid device fabrication at M.S. Kennedy Corporation.

2.0 APPLICATION:

This procedure shall apply to all passive elements as follows:

2.1 Condition A - Elements to be used in "fully" compliant hybrid products as defined in MIL-PRF-38534 (Class H, G, D, E). Purchase order shall not delete any of the requirements of this specification. Note 1.

For MIL-STD-981 inductors or transformers, Class B lot control applies, see Para. 6.1 for requirements.

2.2 Condition B - Elements intended to be used in full compliance with MIL-PRF-38534 (Class H, G, D, E) but element evaluation will be the responsibility of M.S. Kennedy. Note 1

For MIL-STD-981 inductors or transformers, Class B lot control applies, see Para. 6.2 for requirements.

2.3 Condition C - Elements to be used on customer source control drawings or MSK standard product which do not impose MIL-PRF-38534. See Para. 6.3 for requirements.

2.4 Condition D - Elements to be used in compliant MIL-PRF-38534 Class K hybrid products. Note 1.

For MIL-STD-981 inductors or transformers, Class S lot control applies, see Para. 6.4 for requirements.

2.5 Condition E - Elements tested IAW the MSK SCD

2.6 Conflicting Requirements:


In the event of conflict between requirements of this specification and other requirements, the following shall apply in order of precedence:

- a. Purchase order
- b. Detail specification control drawing
- c. This specification
- d. Other documents referenced

NOTE 1: This evaluation is not required when the elements are acquired from the established reliability series of military specifications and the element meets or exceeds the evaluation requirements of this specification and is listed on the QPL.

3.0 REFERENCE DOCUMENTS:

- 3.1 Applicable Military Standards.
- 3.2 Applicable MSK source control part drawing.
- 3.3 MSK purchase order.

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	ENGINEERING CHECK	DATE	6			
	QUALITY ASSURANCE	DATE	5			
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4.0 DEFINITIONS:

4.1 **Element** - A constituent of the hybrid microcircuit that contributes directly to its operation.

4.2 **Wafer Lot** - A lot of elements processed in a manner that required every wafer to be subjected to each batch process step as a group. Each wafer lot shall be assigned a unique identification that provides traceability to all processing steps.

4.3 Inspection Lot

4.3.1 MIL-PRF-38534 Inspection Lot. An inspection lot shall consist of passive elements of a single circuit type submitted at one time for inspection to determine compliance with the applicable requirements and acceptable criteria.

4.3.2 MIL-STD-981 Inspection Lot.

4.3.2.1 Class B. An Inspection lot shall include completely assembled devices of the same grade, construction, class, family, and electrical characteristics, manufactured under essentially the same conditions and having similar construction and materials. (Similar construction and materials shall be construed to include differences that will not affect test results.) Sample units shall be selected to be as much as practical, representative of the volt-ampere range of electrical values and physical dimensions included in the lot.

4.3.2.2 Class S. An inspection lot shall consist of completely assembled devices of a single grade construction, class, family, and part number from one procurement document. Each lot shall meet all the lot controls specified for Class S devices.

4.4 **Element Evaluation** - As applicable to this specification shall consist of passive elements per MIL-PRF-38534.

4.5 Environmentally controlled area:

4.5.1 Class 8 per ISO 14644-1, -2 (Class 100,000 per MIL-STD-209) or equivalent.

4.5.2 Temperature - 25°C +3, -5°C

4.5.3 Pressure - A minimum true pressure of 0.03 in. of water between the controlled area and any area not controlled with all entryways closed.

4.5.4 Humidity - RH 30 to 65%.

5.0 REQUIREMENTS:**5.1 General:**

5.1.1 The vendor must have a quality system that meets the requirements of MIL-I-45208, ISO9001 or AS9100. For inductors and/or transformers, the vendor may have a quality system that meets the requirements of MIL-STD-981. The calibration system shall meet MIL-STD-45662, ANSI/NCSS Z540-1, ISO10012-1/ISO10012-2 or equivalent.

5.1.2 The vendor shall notify M.S. Kennedy in writing of any Class I (major) change of product or process as defined in MIL-STD-480, MIL-PRF-38534 or other equivalent document.

5.1.3 All material and processes used by vendor will be suitable for polymeric adhesive, soldering or eutectic die mounting where specified. Pad metallization shall be suitable for thermosonic, ultrasonic and thermocompression bonding of gold or aluminum wire and shall be capable of withstanding a pull test as specified per MIL-STD-883 Method 2011, where applicable to element type.

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- 5.1.4 All electrical test and visual inspection may be done at the element level provided rejects are identified and removed from the lot.
- 5.1.5 Certificate of Compliance shall be signed by a responsible vendor official and shall be enclosed with each shipment with the following minimum information.
 - a. Device type
 - b. Supplier's name and address
 - c. Manufacturer's name (if applicable)
 - d. Device quantity
 - e. Purchase order number
 - f. Applicable MSK drawing number and revision level
 - g. Wafer lot number (if applicable)
- 5.1.6 M.S. Kennedy, MSK's Customer or Regulatory Agency reserves the right to review any vendor program, process and data to assure conformance to the requirements of this specification, the purchase order and the applicable MSK Source Control Drawing.
- 5.1.7 The vendor shall have evidence of a working operator training and certification program. This program shall also include a written description of each process available to the operator.
- 5.1.8 The manufacturer shall flow down any applicable requirements to the sub-tier supplier.

6.0 PROCEDURE:

6.1 Condition A:

- 6.1.1 The vendor shall have an accepted internal document for visual inspection to MIL-STD-883 , Method 2032, or MIL-STD-981 as applicable to ensure compliance.
- 6.1.2 The vendor shall perform 100% visual test to an in-house control document in an environmentally controlled area (see 4.5) and ensure compliance to all mechanical specifications.

For MIL-PRF-38534, the vendor shall perform 100% electrical testing at 25°C and element evaluation shall be performed by the vendor for each inspection lot (see 4.3) in accordance with MIL-PRF-38534 for Class H devices to ensure compliance with the manufacturer's electrical characteristics and/or applicable MSK Source Control Drawing.

For MIL-STD-981, the vendor shall perform 100% screening to Class B of MIL-STD-981 and 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical characteristics and/or applicable source control drawing.

Documentation and test samples will be provided with each lot unless generic data is available.

- 6.1.3 Devices shall be capable of operating over full temperature range meeting minimum and maximum electrical specifications. For specific applications, element characteristics may require testing over this temperature range and will be specified on the MSK source control drawing.

6.1.4 Delivery Conditions:

- 6.1.4.1 The vendor is responsible for ensuring that elements are packaged properly so as to avoid damage during shipment


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- 6.1.4.2 Thick film and thin film resistors, thin film resistor networks and MOS capacitors are to be packed in waffle type containers or trays and sealed in electrostatic-free bags. Thickfilm and thinfilm substrates shall be packaged to prevent damage during shipment. Inductors and transformers shall be packaged to prevent damage during shipment.
- 6.1.4.3 The type of element, name of manufacturer, quantity and lot number are to be clearly marked on each packing container. Markings shall be sufficient for element lot traceability.
- 6.1.4.4 A certificate of compliance, as defined in paragraph 5.1.5, signed by the responsible vendor official, shall be enclosed with each element shipment received.
- 6.1.4.5 Required Documentation - Evidence of the vendor's inspection performance shall be maintained at the vendor's facility. The evidence maintained should include the following:
 - a. Name of operation, specification number and revision of each process or test.
 - b. Part number, wafer lot number and manufacturer internal lot identification number (s).
 - c. Date (s) of test and operator identification.
 - d. Calibration control number and calibration due date of all test equipment.
 - e. Quantity tested and rejected for each process or test and actual quantity tested if sampled.
 - f. Specific major conditions of test that are verifiable by operator including times and temperatures.
 - g. For electrical test, test program number and revision.
 - h. Test data (ie electrical data, bond pull data).

6.2 Condition B:

- 6.2.1 The vendor shall have an accepted internal document for visual inspection to MIL-STD-883, Method 2032 or MIL-STD-981 as applicable to ensure compliance.
- 6.2.2 The vendor shall perform visual inspection to an in-house sample plan in an environmentally controlled area (see 4.5) and ensure compliance to all mechanical specifications.
- 6.2.3 For MIL-PRF-38534, the vendor shall perform electrical test at 25°C to an in-house sample plan to ensure compliance to the manufacturer's electrical characteristics and/or MSK applicable source control drawing.

For MIL-STD-981, the vendor shall perform 100% visual inspection and electrical testing to ensure compliance to the manufacturer's electrical characteristics and/or MSK applicable source control drawing. Screening in accordance with MIL-STD-981 is not required.
- 6.2.4 Devices shall be capable of operating over full temperature range meeting minimum and maximum electrical specifications. For specific applications, element characteristics may require testing over this temperature range and will be specified on the MSK source control drawing.
- 6.2.5 Delivery conditions shall be in accordance with paragraph 6.1.4.

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6.3. Condition C:

6.3.1 The vendor shall guarantee performance of the elements to conform to the electrical and mechanical specification in the applicable MSK source control/part drawing.

6.3.2 Delivery Conditions:

6.3.2.1 The vendor is responsible for ensuring that elements are packaged properly so as to avoid damage during shipment.

6.3.2.2 Thick film and thin film resistors, thin film resistor networks and MOS capacitors are to be packed in waffle type containers or trays and sealed in electrostatic-free bags. Thickfilm and thinfilm substrates shall be packaged to prevent damage during shipment. Inductors and transformers shall be packaged to prevent damage during shipment.

6.3.2.3 The type of element, name of manufacturer, quantity and lot number are to be clearly marked on each packing container. Markings shall be sufficient for element lot traceability.

6.3.2.4 A certificate of compliance, as defined in paragraph 5.1.5, signed by the responsible vendor official, shall be enclosed with each element shipment received.

6.4 Condition D:

6.4.1 The vendor shall have an accepted internal document for visual inspection to MIL-STD-883, Method 2032, or MIL-STD-981 as applicable to ensure compliance.

6.4.2 a. For MIL-PRF-38534 the vendor shall perform 100% electrical testing at 25°C and element evaluation shall be performed by the vendor for each inspection lot (see 4.3) in accordance with MIL-PRF-38534 for Class K devices to ensure compliance with the manufacturer's electrical characteristics and/or applicable MSK Source Control Drawing.

b. For MIL-STD-981, the vendor shall perform 100% screening to Class S, 100% electrical testing and Group B lot acceptance testing IAW MIL-STD-981 for Class S inductors/transformers. The testing shall be performed by the vendor for each inspection lot (see 4.3) to ensure compliance with the manufacturer's electrical characteristics and/or applicable MSK Source Control Drawing.

6.4.3 Delivery Conditions:

6.4.3.1 The vendor is responsible for ensuring that elements are packaged properly so as to avoid damage during shipment.

6.4.3.2 Thick film and thin film resistor, thin film resistor networks and MOS capacitors are to be packed in waffle type containers or trays and sealed in electrostatic-free bags. Thickfilm and thinfilm substrates shall be packaged to prevent damage during shipment.

6.4.3.3 The type of element, name of manufacturer, quantity and lot number are to be clearly marked on each package container. Markings shall be sufficient for element lot traceability.

6.4.3.4 A certificate of compliance, as defined in paragraph 5.1.5, signed by the responsible vendor official, shall be enclosed with each element shipment received.

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6.4.3.5 Required Documentation - Written evidence of the vendor's inspection performance will be submitted with the inspection lot. The written evidence will contain a copy of the vendor's lot traveler or attributes data containing the following information:

- a. Name of title of operation, specification number and revision of each process or test.
- b. Identify part number, wafer lot number and manufacturer internal lot identification number(s).
- c. Date(s) of test and operator identification.
- d. Calibration control number and calibration due date of all test equipment.
- e. Quantity tested and rejected for each process or test and actual quantity tested if sampled.
- f. Specific major conditions of test that are verifiable by operator including times and temperatures.
- g. For electrical test, test program number and revision.
- h. Test data (ie. electrical data, bond pull data)

6.5 Condition E:

6.5.1 The vendor shall guarantee performance of the elements to conform to the specification called out in the applicable MSK source control/part drawing.

6.5.2 Delivery Conditions:

6.5.2.1 The vendor is responsible for ensuring the elements are packaged properly so as to avoid damage during shipment.

6.5.2.2 Thick film and thin film resistors, thin film resistor networks and MOS capacitors are to be packed in waffle type containers or trays and sealed in electrostatic-free bags. Thickfilm and thinfilm substrates shall be packaged to prevent damage during shipment. Inductors and transformers shall be packaged to prevent damage during shipment.

6.5.2.3 The type of element, name of manufacturer, quantity and lot number are to be clearly marked on each packing container. Markings shall be sufficient for element lot traceability.


6.5.2.4 A certificate of compliance, as defined in paragraph 5.1.5, signed by the responsible vendor official, shall be enclosed with each element shipment received.

7.0 QUALITY ASSURANCE PROVISIONS:

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

7.2 M.S. Kennedy reserves the right to review any vendors' program, process and data to assure conformance to the requirements of this specification, purchase order and the applicable SCD.

NOTE: WHERE PROPRIETARY YIELD DATA WOULD BE REVEALED DURING 100 PERCENT INSPECTIONS, THE USE OF ONLY A "QUANTITY ACCEPTED" COLUMN OF THE TRAVELER SHALL BE ACCEPTABLE.

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8.0 ACCEPT/REJECT CRITERIA:

- 8.1 Accept all lots which pass the applicable paragraphs of this procedure and the source control drawing.
- 8.2 Reject any device(s) and separate it from the lot which fails an electrical parameter or visual criteria.
- 8.3 Reject any lot which does not pass element evaluation.

9.0 REFERENCE DOCUMENTS:

- 9.1 MIL-STD-883 test methods and procedures for microelectronics
- 9.2 Applicable source control drawing
- 9.3 M.S. Kennedy purchase order
- 9.4 MIL-STD-981 design, manufacturing and quality standard for custom electromagnetic devices for space applications
- 9.5 DOD-STD-480 military standard, configuration control engineering changes, deviations and waivers
- 9.6 MIL-I-45208, ISO 9001 OR AS9100
- 9.7 MIL-STD-750 test method and procedures for semiconductor
- 9.8 MIL-PRF-38534
- 9.9 ISO 14644-1, -2 or equivalent
- 9.10 MIL-STD-45662, ANSI/NCSL Z540-1 or ISO10012-1/ISO10012-2 or equivalent calibration systems.

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