MSK DWG. NO.	REV.	SHEET	SCALE	SIZE
1019-1618	L	1 OF 9	NTS	A

REVISIONS

REV.	ECO NO.	DESCRIPTION OF UPDATE	APPROVED	DATE
-	RLSD		D. MILLER	02/87
A	1481		D. MILLER	08/88
B	2054		D. MILLER	12/90
C	2203		C. HEISELMAN	03/91
D	3183		C. HEISELMAN	12/08/92
E	5227		C. HEISELMAN	07/10/96
F	6716		C. HEISELMAN	04/16/98
G	9581		C. HEISELMAN	12/27/01
H	10824		C. HEISELMAN	03/19/03
J	11715		C. HEISELMAN	07/11/04
K	13372		C. HEISELMAN	03/23/06
L	16865	Add 4.1.3 flow down to subtier	[signature]	01/21/10

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APPROVALS

FSCM NO. 51651

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QUALITY ASSURANCE	[signature]	1/21/10

MATERIAL N/A

FINISH N/A

TITLE: MICROCIRCUIT / SEMICONDUCTOR PROCUREMENT

MSK DWG. NO. 1019-1618 REV. L SHEET 1 OF 9

DEPARTMENT / COPY NO.

1.0 PURPOSE:

The purpose of this document is to define the vendor requirements of all procured microcircuit elements (Integrated Circuits) and semiconductor elements (diodes, transistor, etc.) used in M.S. Kennedy hybrid microcircuits.

2.0 APPLICATION:

This procedure shall apply to all microcircuit elements and semiconductors 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.

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

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

2.4 **Condition D** - Elements to be used in compliance with MIL-PRF-38534 Class K hybrid products. Note 2.

2.5 **Condition E** - Elements to be used in compliance with MIL-PRF-38534 Class K hybrid products. When specified on the PO, 12 die shall be packaged and shipped to MSK for Radiation Testing. Note 2.

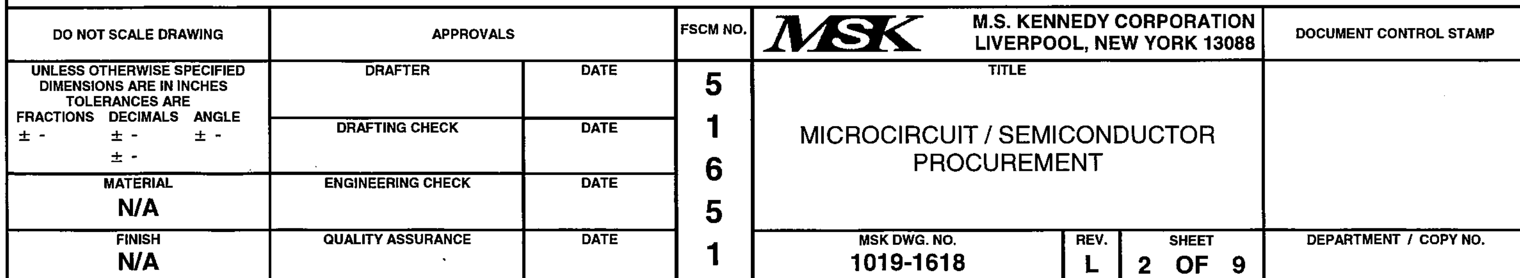
2.6 Conflicting Requirements:

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/specification control drawing (SCD)
- **c.** This specification
- **d.** Other documents referenced

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 - A lot of elements processed in a manner that requires 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.

3.4 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.

3.5 Element Evaluation - As applicable to this specification shall consist of Microcircuit/Semiconductor die per MIL-PRF-38534.

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

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

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

3.6.3 Humidity - RH 30 to 65%

3.6.4 Positive Pressure .01" water column or greater

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

4.0 REQUIREMENTS:

4.1 General:

4.1.1 The vendor shall have a quality system that meets or exceeds the requirements of MIL-I-45208, ISO9001 or AS9100 (or equivalent) and a calibration system that meets MIL-STD-45662, ANSI/NCSL Z540-1, ISO10012-1/ISO10012-2 or equivalent.

4.1.2 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 Configuration Control or equivalent document (ie. MIL-PRF-38534, MIL-PRF-19500, MIL-PRF-38535).

4.1.3 The manufacturer shall flow down any applicable requirements to the sub-tier supplier.

4.1.4 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 thermo sonic, 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.

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

4.1.6
- Condition A semiconductor elements shall meet the requirements of para 4.1 and 4.2.
- Condition A microcircuit elements shall meet the requirements of para 4.1 and 4.3.
- Condition B semiconductor and microcircuit elements shall meet the requirements of para 4.1 and 4.4.
- Condition C semiconductor and microcircuit elements shall meet the requirements of 4.1.4, 4.1.5, 4.1.7, 4.1.8, and 4.5.
- Condition D semiconductor elements shall meet the requirements of para 4.1 and 4.6.
- Condition D microcircuit elements shall meet the requirements of para 4.1 and 4.7.
- Condition E Semiconductor shall meet the requirements of para. 4.1 and 4.6
- Condition E microcircuit elements shall meet the requirements of para 4.1 and 4.7.

4.1.7 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. Lot number

4.1.8 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.

4.1.9 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.

4.2 **Condition A** - Die processor requirements for semiconductor elements (transistor and diode dice).

4.2.1 The die processor shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical data book and/or MSK applicable source control drawing. For specific applications, an element may require testing over full temperature range. This shall be specified on the MSK source control drawing and will be handled on an individual basis.

4.2.2 The die processor shall have an accepted internal document for visual inspection to MIL-STD-883, Method 2010 or MIL-STD-750, Method 2069, 2070, 2072, 2073 as applicable to ensure compliance.

4.2.3 The die processor shall perform 100% visual inspection to an in-house control document in an environmentally controlled area (see 3.6) and ensure compliance to all mechanical specifications.

4.2.4 Element evaluation shall be performed by the die processor for each inspection lot (see 3.4) in accordance with MIL-PRF-38534 for Class H elements.

4.2.5 **Delivery Conditions:**

a. **Packaging** - Dice shall be packaged in conductive waffle type containers then sealed in an electrostatic bag. Individual die shall be separated from all others, physically restrained from vibration and mechanically isolated from shock that could cause damage or degradation to the part.

b. **Marking** - The dice type, manufacturer's name, quantity and inspection lot number shall appear on each waffle pack. All samples and test data shall be identified by its device type, manufacturer's name and inspection lot number. Markings shall be sufficient for inspection lot traceability (See 3.4).

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

1. Attributes Data
2. Test Data

d. A **certificate of compliance** as defined in paragraph 4.1.7 signed by the responsible vendor official shall be enclosed with each element shipment lot.

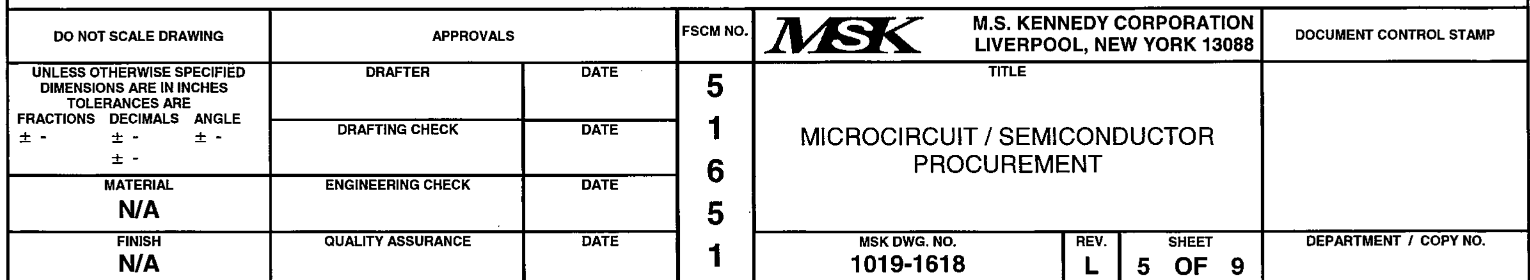
4.3 **Condition A** - Die processor requirements for microcircuit elements (integrated circuits).

4.3.1 The die processor shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical data book and/or MSK applicable source control drawing.

4.3.2 The die processor shall have an accepted internal document for visual inspection to MIL-STD-883 Method 2010 Condition B, with evidence of a trained operator.

4.3.3 The die processor shall perform 100% visual inspection to an in-house approved control document in an environmentally controlled area (see 3.6).

4.3.4 Element evaluation shall be performed by the die processor on each inspection lot (see 3.4) in accordance with MIL-PRF-38534 for Class H elements. Final electrical test shall consist of static and dynamic (as applicable) parameters at an ambient of 25°C. Static tests shall also be tested at maximum operating temperatures (-55°C to 125°C) unless otherwise specified. MSK reserves the right to repeat these tests on the same elements delivered with each lot.



4.3.5 Delivery Conditions:

a. **Packaging** - Dice shall be packaged in conductive waffle type containers then sealed in an electrostatic bag. Individual die shall be separated from all others, physically restrained from vibration and mechanically isolated from shock that could cause damage or degradation to the part.

b. **Marking** - The dice type, manufacturer's name, quantity and inspection lot number shall appear on each waffle pack. All samples and test data shall be identified by its device type, manufacturer's name and inspection lot number. Markings shall be sufficient for inspection lot traceability (See 3.4).

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

1. Attributes Data
2. Test Data

d. A **certificate of compliance** as defined in paragraph 4.1.7 signed by the responsible vendor official shall be enclosed with each element shipment lot.

4.4 Condition B - Die processor requirements of all semiconductor elements (transistors and diode dice) and microcircuits (integrated circuits).

4.4.1 The die processor 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 to ensure compliance. The die processor shall perform visual inspection to an in-house sample plan in an environmentally controlled area (see 3.6) and ensure compliance to all mechanical specifications.

4.4.2 Microcircuits shall be glassivated over metallized areas except on bonding pads. Pads shall be capable of passing wire bond evaluation per MIL-STD-883, Method 2011.

4.4.3 Each die must be 100% electrically tested at 25°C to ensure compliance to the manufacturer's electrical characteristics and/or MSK applicable source control drawing.

4.4.4 Devices shall be capable of operating over full temperature range to minimum and maximum electrical data book specifications.

For specific applications, element characteristics may require testing over this temperature range and will be specified on the MSK source control drawing.

4.4.5 Delivery conditions shall be in accordance with 4.2.5 (a) packaging, (b) marking, (d) certificate of compliance.

4.5 Condition C - Elements procured for SCD & Standard Product.

4.5.1 The die processor shall perform 100% electrical testing at 25°C.

All electrical rejects shall be marked with solvent resistant ink.

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

4.5.2 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 lot (see 4.5.3) to assure conformance.

4.5.3 <u>**Lot Control**</u>- Die supplied under this specification shall be manufactured in homogenous lots. The homogenous lot shall be defined as a lot of identical die manufactured to the same drawing, same drawing revision, same specification, and same specification revision in one unchanged process.

4.5.4 <u>**Preservation and packaging**</u>- Individual die shall be separated from all others, physically restrained from vibration and mechanically isolated from shock that might cause damage or degradation to the part.

4.5.5 A **certificate of compliance** is required for all orders.

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

4.6.1 The die processor shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical characteristics and/or MSK applicable source control drawing. For specific applications, an element may require testing over full temperature range. This shall be specified on the MSK source control drawing and will be handled on an individual basis.

4.6.2 The die processor shall have an accepted internal document for visual inspection to MIL-STD-883, Method 2069, 2070, 2072, 2073 as applicable to ensure compliance.

4.6.3 The die processor 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.

4.6.4 Element evaluation shall be performed by the die processor for each inspection lot (see 3.4) in accordance with MIL-PRF-38534 for Class K elements. <u>Test samples shall be delivered with each lot</u>.

4.6.5 <u>**For Condition E only**</u> 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.

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

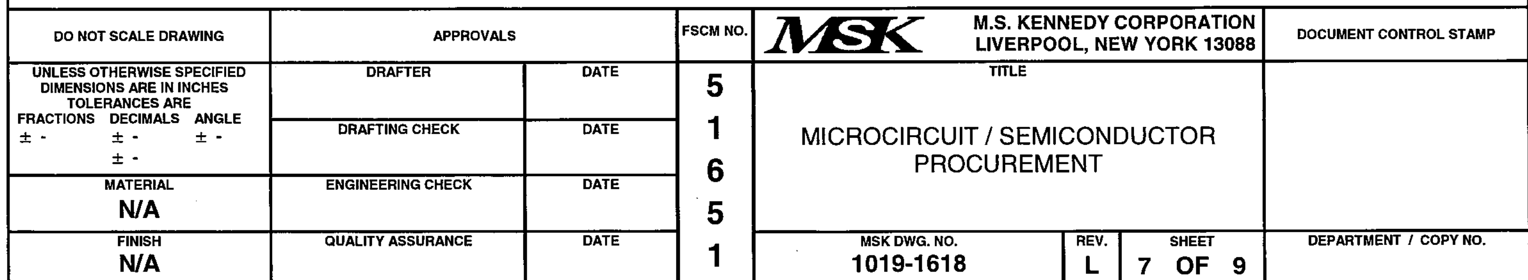
a. <u>**Packaging**</u> - Die shall be packaged in conductive waffle type containers then sealed in an electrostatic bag. Individual die shall be separated from all others, physically restrained from vibration and mechanically isolated from shock that could damage or degradation to the part.

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 (See 3.4).

c. <u>**Required Documentation**</u> - Die processor performance data to be submitted with the inspection lot:

1. Attributes data.
2. Test data

d. A **certificate of compliance** as defined in paragraph 4.1.7 signed by the responsible vendor official shall be enclosed with each element shipment lot.



4.7 **Condition D and E**- Die processor requirements for microcircuit elements (Integrated Circuits) and for radiation (as applicable) tested elements.

4.7.1 The die processor shall perform 100% electrical testing at 25°C to ensure compliance to the manufacturer's electrical characteristics and/or MSK applicable source control drawing.

4.7.2 The die processor shall have an accepted internal document for visual inspection to MIL-STD-883 Method 2010 Condition A, with evidence of a trained operator.

4.7.3 The die processor shall perform 100% visual inspection to an in-house approved control document in an environmentally controlled area (See 3.6).

4.7.4 Element Evaluation shall be performed by the die processor on each inspection lot (see 3.4) in accordance with MIL-PRF-38534 for Class K elements. Final electrical test shall consist of static and dynamic (as applicable) parameters at an ambient of 25°C. Static tests shall also be tested at maximum operating temperatures (-55°C to 125°C) unless otherwise specified. MSK reserves the right to repeat these tests on the same elements delivered with each lot.

Test samples shall be delivered with each lot.

4.7.5 **For Condition E only** and 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.

4.7.6 **Delivery Conditions:**

a. **Packaging** - Die shall be packaged in conductive waffle type containers then sealed in an electrostatic bag. Individual die shall be separated from all others, physically restrained from vibration and mechanically isolated from shock that could cause damage or degradation to the part.

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 (See 3.4).

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

1. Attributes data.
2. Test data

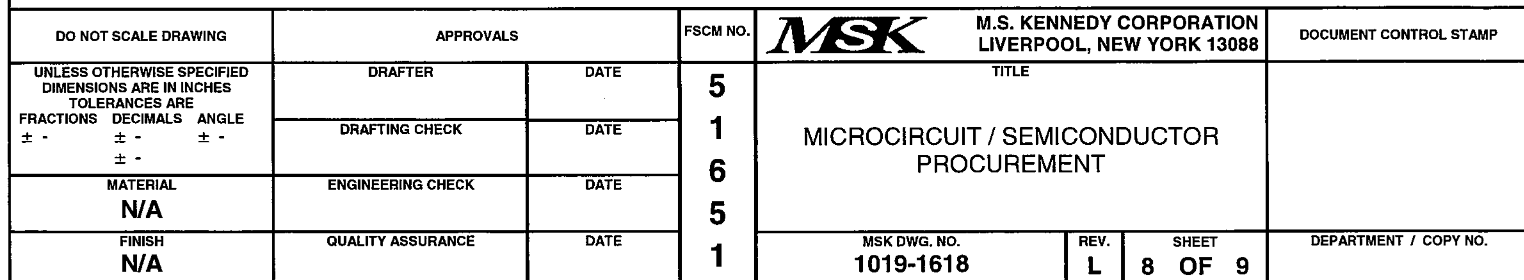
d. A **certificate of compliance** as defined in paragraph 4.1.7 signed by the responsible vendor official shall be enclosed with each element shipment lot.

5.0 ACCEPT/REJECT CRITERIA:

5.1 Accept all lots which pass the applicable paragraphs of this procedure and the source control drawing.

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

5.3 Reject any inspection lot which does not pass element evaluation.



6.0 QUALITY ASSURANCE PROVISIONS:

6.1 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.

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

7.0 REFERENCE DOCUMENTS:

7.1 MIL-STD-883 test methods and procedures for microelectronics.

7.2 Applicable source control drawing.

7.3 M.S. Kennedy purchase order.

7.4 MSK internal element evaluation procedure (RIP 005).

7.5 DOD-STD-480 military standard, configuration control engineering changes, deviations and waivers.

7.6 MIL-I-45208, ISO9001 or AS9100

7.7 MIL-STD-750 test method and procedures for semiconductors.

7.8 MIL-PRF-38534

7.9 MIL-PRF-19500

7.10 MIL-PRF-38535

7.11 MIL-STD-45662, ANSI/NCSL Z540-1, ISO10012-1/ISO10012-2 or equivalent

7.12 ISO14644-1, -2 or equivalent