### Class H

### <u>Class K</u>

## 3.2.1.6 Metallization overlap.

- a. Contact overlap between the upper and lower metallizations that is less than 50 percent of the designed contact overlap area (see figure 2032-42h).
   NOTE: The overlap area is that area in which the upper metallization actually contacts the lower metallization.
- a. Same as class H.



FIGURE 2032-42h. Class H metallization overlap criterion.

Class H	<u>Class K</u>
3.2.1.7 <u>Metallized through-hole defects, "low magnification"</u> . No element shall be acceptable that exhibits:	
<ul> <li>Through-hole metallization that is not vertically continuous or that does not cover at least a continuous 50 percent of the inside, circumferential surface area unless by design.</li> </ul>	a. Same as class H.
3.2.1.8 <u>Wrap-around connection defects, "low magnification"</u> . No element shall be acceptable that exhibits:	
<ul> <li>Unmetallized area in the edges of wrap-around connections greater than 50 percent of the largest dimension of the edge metallization (see figure 2032-43Ah).</li> </ul>	a. Same as class H.
REJECT- x > d/2	WRAP-AROUND CONNECTION

FIGURE 2032-43Ah. Class H wrap-around connection unmetallized area criterion.

Class H

a.

b.

# 3.2.2 Substrate defects, "low magnification". No element shall be acceptable that exhibits: Less than 1.0 mil separation between the a. Same as class H. operating metallization and the edge of the element unless by design (see figure 2032-43h). NOTE: This criterion does not apply to substrates designed for wraparound conductors. Same as class H. A chipout that extends into the b. active circuit area (see figure 2032-43h). У REJECTy < 0.1 MIL ÚNLESS BY DESIGN REJECT-CHIPOUT INTO ACTIVE CIRCUIT AREA \_\_\_\_\_

FIGURE 2032-43h. Class H separation and chipout criteria.

- Any crack that exceeds 5.0 mils in length c. Same as Class H. c. (see figure 2032-44h). NOTE: For fused quart or crystalline substrates, no cracking is allowed.
- d. Any crack that does not exhibit 1.0 mil of separation from any active circuit area or operating metallization (see figure 2032-44h).

Class K

d. Same as class H.



Class K

Same as class H.





3.2.2

e.

- 3.2.2 e. Any crack exceeding 1.0 mil in length extending from the element edge directly towards the active circuit area or operating metallization (see figure 2032-44h).
  - f. N/A

f. Semicircular crack or combination of cracks along the element edge whose total length is equal to or greater than 75 percent of the narrowest separation between any two bonding pads (see figure 2032-45k).





		<u>Class H</u>			<u>Class K</u>
3.2.2	g.	An attached portion of a circuit area from an adjacent element.	3.2.2	g.	Same as class H.
	h.	Any crack that does not originate at an edge.		h.	Same as class H.
	i.	Holes through the substrate, unless by design.		i.	Same as class H.
	j.	Patterned substrates having a section broken out around a substrate mounting hole (intended for substrate-to-post attachment) that is greater than 25 percent of the mounting hole circumference.		j.	Same as class H.

### Class H

### <u>Class K</u>

- 3.2.3 <u>Thick film resistor defects, "low magnification"</u>. No element shall be acceptable that exhibits:
  - a. A reduction of the resistor at the terminal due to voids to less than 50 percent of the original resistor width (see figure 2032-46h).



FIGURE 2032-46h. Class H resistor width reduction at terminal caused by voids criterion.

- Reduction of the resistor at the terminal, due to neckdown less than 50 percent, to of the original resistor width (see figure 2032-47h).
- b. Same as Class H.

a. Same as Class H.

<u>Class H</u>

<u>Class K</u>



FIGURE 2032-47h. Class H resistor width reduction at terminal by neckdown criterion.

3.2.3	C.	Any resistor film lifting, peeling, or blistering.	3.2.3	C.	Same as class H.
	d.	Crack in the resistor greater than 1.0 mil in length. NOTE: Irregularities such as fissures in resistor material that are created during firing, and that do not expose the underlying material, are not considered to be cracks.		d.	Same as class H.
	e.	Evidence of resistor repair by overprinting or any other means.		e.	Same as class H.
	f.	Separation between any two resistors that is less than 50 percent of the original separation.		f.	Same as class H.
	g.	Separation between any resistor and conductor combination that is less than 50 percent of the original separation.		g.	Same as class H.
	h.	Increase in resistor width greater than 25 percent of the original design width.		h.	Same as class H.
	i.	Resistor that is closer than 1.0 mil to the edge of the substrate.		i.	Same as class H.



- Contact overlap between the metallization and the resistor in which the actual width dimension "y" is <u>less than 50 percent</u> of the original resistor width (see figure 2032-49h).
- k. Less than 75 percent (see figure 2032-49k).



FIGURE 2032-49h. Class H resistor overlap criterion.



FIGURE 2032-49k. <u>Class K resistor overlap</u> <u>criterion</u>.

<u>Class H</u>					<u>Class K</u>
3.2.3	I.	Contact overlap between the metallization and the resistor in which the length dimension "x" is less than 3.0 mils (see figure 2032-50h).	3.2.3	I.	Same as class H.



FIGURE 2032-50h. Resistor overlap criterion.

- m. Voids or misalignment of glassivation that results in less than 90 percent coverage of the resistor area, unless by design.
- n. Crazing of glassivation over a resistor.
- o. Glassivation scratches, lifting, or peeling that expose any portion of a resistor.
- m. Same as class H.
- n. Same as class H.
- o. Same as class H.

### Class H

### Class K

3.2.4 <u>Trimmed thick film resistor defects, "low</u> <u>magnification"</u>. No element shall be acceptable that exhibits: NOTE: The trim defect criteria contained in this

section apply to active resistor areas only.

- A kerf width less than 0.5 mil (see figure 2032-51h).
   NOTE: This does not apply to edge trimming.
- a. Same as class H.



## FIGURE 2032-51h. Class H kerf width criteria.

- b. A kerf containing detritus.
- A kerf which extends into metallization and leave less than 75 percent of the metallization width undisturbed (see figure 2032-52h).
   NOTE: Opening a metallization link by design is acceptable.
- b. Same as class H.
- c. Same as class H.



FIGURE 2032-52h. Class H laser trim kerf extension into metallization criteria.

## Class H

3.2.4 d.

3.2.4 d. A kerf that leaves less than 50 percent 3 of the original width of a resistor, unless by design (see figure 2032-52Ah).
 PRECAUTIONARY NOTE: The maximum allowable current density requirement shall not be exceeded.



FIGURE 2032-52Ah. Class H resistor width reduction and untrimmed resistor material criteria.

- e. A trim that does not originate from the edge of the resistor.
- e. Same as class H.
- 3.2.5 <u>Multilevel thick film defects, "low</u> <u>magnification"</u>. No element shall be acceptable that exhibits:
  - a. Any insulating material that does not extend beyond the width of the upper and lower metallization by 3.0 mils minimum (see figure 2032-53h).
- a. Same as class H.



FIGURE 2032-53h. Class H dielectric extension criteria.

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<u>Class K</u>

Same as class H.

		<u>Class H</u>			<u>Class K</u>
3.2.5	b.	Voids in the insulating material that expose underlying metallization.	3.2.5	b.	Same as class H.
	C.	Vias that are less than 50 percent of the original design area.		C.	Same as class H.
	d.	Scratch that completely crosses the metallization and damages the insulating material surface on either side.		d.	Same as class H.

3.2.6 <u>All thin film capacitors and those overlay capacitors used in GaAs microwave devices,"low</u> <u>magnification"</u>. No element shall be acceptable that exhibits:

- a. Scratches that expose an underlying material.
- b. Any peeling or lifting of the metallization.
- c. Excess top metal which extend beyond the capacitor bottom metal.
- d. Voids in the capacitor bottom metal which extend under the capacitor top metal.
- e. Voids in the top metallization which leaves less than 75% of the metallization area undisturbed.

3.3 <u>Nonplanar element inspection</u>. Inspection for visual defects described in this section shall be conducted on each nonplanar passive element. The "low magnification" inspection shall be within the range of 10X to 60X.

#### Class H

3.3.1 <u>General nonplanar element defects.</u> <u>"low magnification"</u>. No element shall be acceptable that exhibits:

- a. Peeling or lifting of any metallization.
- Protrusion between metallization terminals that leaves less than 5.0 mils separation (see figure 2032-54h).
- a. Same as class H.

Class K

b. Same as class H.



FIGURE 2032-54h. Class H metallization protrusion criterion.

		<u>Class H</u>			<u>Class K</u>
3.3.1	C.	Lifting, blistering, or peeling of insulation.	3.3.1	C.	Same as class H.
	d.	Voids in metallized terminals that expose underlying material over greater than 25 percent of any side of the metallized terminal area.		d.	Same as class H.
3.3.2 <u>Fo</u> No	oreigr eler	n material defects "low magnification". nent shall be acceptable that exhibits:			
	а.	For mounted elements, unattached, conductive foreign material on the surface of the element. For unmounted elements, unattached, conductive foreign material on the surface of the element that is large enough to bridge operating metallization path, active circuitry, or any combination of these. NOTE: If an element has an insulating layer (such as glassivation) that covers operating metallization paths, active circuitry, or any combination of these, then the presence of unattached conductive foreign material that is large enough to bridge these features is acceptable since the features are protected by the insulating layer. NOTE: All foreign material shall be considered to be unattached unless otherwise verified to be attached. Verification of attachment shall be accomplished by a light touch with an appropriate mechanical device (i.e., needle, probe, pick, etc.) by a suitable cleaning process approved by the acquiring activity, or by a blow-off with a nominal gas blow (approximately 20 psig). NOTE: Semiconductor particles are considered to be foreign material. NOTE: Removal of unattached foreign material may be attempted using the techniques for verification of attachment discussed above.		a.	Same as class H.
	b.	Attached, conductive foreign material that bridges metallization paths, active circuitry, or any combination of these.		b.	Same as class H.
	C.	Liquid droplets, inkdrops, or any chemical stain that appear to bridge any unglassivated active circuit areas.		C.	Same as class H.
	d.	Attached foreign material that covers more than 25 percent of a bonding pad area.		d.	Same as class H.





FIGURE 2032-56h. Class H crack criteria.



		<u>Class H</u>			<u>Class K</u>
3.3.3	e.	Void in the metallized edges of the 3 element that are greater than 10 percent of the metallized edge dimension, or bare corners of metallized terminals (see figure 2032-59h). NOTE: This criteria ia applicable to solder attached elements only.	.3.3	e.	Same as class H.
		REJECT- z > d/10 REJECT BARE C	- ORNE		d
		FIGURE 2032-59h. Class H metalliz	zed edge	e def	ect criteria.
	f.	Attached foreign material on the body that covers an area greater than 5.0 mils square on any side.		f.	Same as class H.
3.3.4	Tantalu magnifi exhibits	m chip capacitor defects, "low cation." No element shall be acceptable that :			
	a.	Flaking or peeling of the encapsulant that exposes any underlying material.		a.	Same as class H.
	b.	A metallized terminal that is less than 90 percent free of encapsulant material.		b.	Same as class H.
	C.	Less than 50 percent continuous metallized terminal weld area without cracks.		c.	Same as class H.
	d.	Metallized terminal containing residue from the welding operation that is not firmly attached metallurgically to the anode cap.		d.	Same as class H.

		Class H		<u>Class K</u>
3.3.4	e.	Metallized terminal not aligned as shown in 3.3 the applicable drawing.	8.4 e.	Same as class H.
	f.	Encapsulant preventing the metallized terminal from resting on the substrate bonding pads when the capacitor is in the bonding position except where the metallized terminal electrical contact is made by alternate means.	f.	Same as class H.
	g.	Lifting, blistering or peeling of metallized terminal encapsulant.	g.	Same as class H.
3.3.5	Paralle <u>"low m</u> that ex	plate chip capacitor defects, agnification". No element shall be acceptable hibits:		
	a.	Metallization that extends greater than 50 percent around the edge of the capacitor (see figure 2032-60h).	a.	Same as class H.
		REJECT - y > d/2		
		FIGURE 2032-60h. <u>Class H metallizat</u>	ion extens	ion criterion.
3.3.5	b.	Evidence of cracks in the dielectric body 3.3 (see figure 2032-61h).	8.5 b.	Same as class H.



FIGURE 2032-61h. Class H crack in dielectric criterion.

### 3.3.6 <u>Inductor and transformer defects, "low</u> <u>magnification"</u>. No element shall be acceptable that exhibits:

- a. Peeling, lifting or blistering of winding metallization or insulation.
- b. Evidence of shorts between adjacent turns or windings.
- c. Cracks or exposure of bare magnetic core material.
- d. Pits or voids in the core insulation greater than 5.0 mils area that expose the magnetic core material.
- e. Separation less than 5.0 mils between wire termination points of the same or adjacent windings.
- f. Missing polarity identification unless by design.
- g. Operating metallization and multilevel thick film defects as described in 3.2.1 and 3.2.5 herein.
- 3.3.7 <u>Chip resistor defects, "low magnification"</u>. No element shall be acceptable that exhibits:
  - Reduction of the resistor width resulting from voids, bubbles, nicks, or scratches, or a combination of these, that leaves less than 50 percent of the narrowest resistor width (see figure 2032-62h).

- a. Same as class H.
  b. Same as class H.
  c. Same as class H.
  d. Same as class H.
  e. Same as class H.
  - f. Same as class H.
  - g. Same as class H.
  - a. Same as class H.



FIGURE 2032-62h. Class H resistor width reduction criterion.

		Class H		<u>Class K</u>
3.3.7	b.	A kerf that leaves less than 50 percent 3.3.7 of the original width of the resistor unless by design.	b.	Same as class H.
	c.	Metallized termination width less than 10.0 mils unless by design (see figure 2032-63h).	c.	Same as class H.
		REJECT- x < 10.0 MILS UNLESS BY DESIGN FIGURE 2032-63h. <u>Class H termination</u>	a width	n criterion.
	Ч	A grack chipaut or void in the substrate	А	Sama as class H

d. A crack, chipout or void in the substrate greater than 3.0 mils in any direction (see figure 2032-64h).

\*

d. Same as class H.



FIGURE 2032-64h. Class H substrate defect criteria.



FIGURE 2032-66h. Class H termination material splatter criteria.