

Tin Whisker MLCC Data Report

Product Research & Development Group Surface Mount Passive Component Team

Product: Multi Layer Ceramic Capacitors (MLCC)

Solder Coat
Finish: 100% matte Tin (Sn) over high porosity Nickel (Ni)

Item: Tin Whisker Growth Testing

P/Ns: 0402 and 0603 MLCC sizes
C0402C0G500-221JNE
C0402X7R160-104KNE
C0603Y5V250-104ZNE

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I. Specific Products for Testing

- A) Dielectrics: NP0, X7R, Y5V
B) Capacitance: 220pF, 0.1uF, 0.1uF
C) Sizes: 0402, 0603

NO.	DIELECTRIC TYPE	CAPACITANCE	PART NO.
1	NP0	220pF	C0402C0G500-221JNE
2	X7R	0.1uF	C0402X7R160-104KNE
3	Y5V	0.1uF	C0603Y5V250-104ZNE

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II. Testing Items and Methods

Tested per NEMI and JEDEC standards and guidelines

Tin Whisker acceptance test requirements – July 2004

JEDEC – JESD22-A104 for temperature cycling

Max. allowable Tin Whisker is $\leq 50\mu\text{m}$

TEST ITEM	TEST METHOD	
Tin Whisker Growth	Temperature / Humidity Storage	Temperature: 85°C
		Humidity: 85% RH
		4000 Hours
	Temperature Cycling	Cycle Temperature: 55°C ~ 85°C
		No. of cycles: 2000 cycles
	Storage	Temperature: 25°C
		4000 Hours

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III. SEM Test Results & Data

Tin Whisker Testing Results

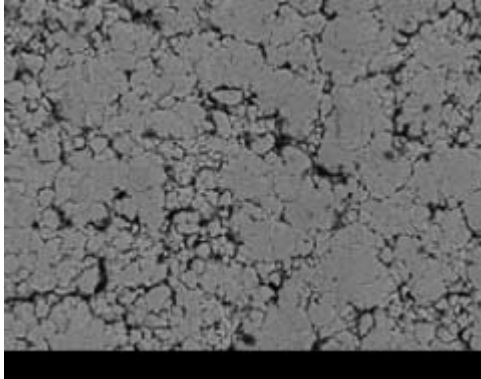
NO.	PART NO.	ITEM	WHISKERS DETECTED	MAX. SIZE (µm)	RESULT
1	C0402C0G500-221JNE	Temperature /Humidity Storage	0/6	0	PASS
		Temperature Cycling	6/6	27.65	PASS
		Storage Test	0/6	0	PASS
2	C0402X7R160-104KNE	Temperature /Humidity Storage	0/6	0	PASS
		Temperature Cycling	6/6	22.81	PASS
		Storage Test	0/6	0	PASS
3	C0603Y5V250-104ZNE	Temperature /Humidity Storage	0/6	0	PASS
		Temperature Cycling	6/6	29.75	PASS
		Storage Test	0/6	0	PASS

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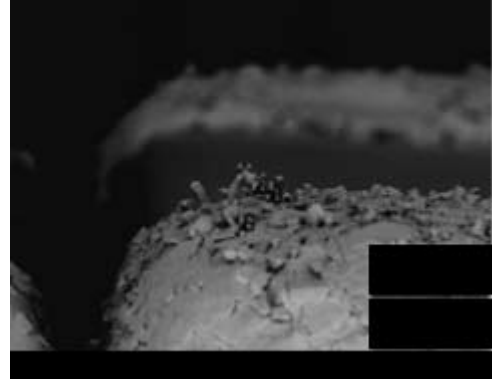
IV. SEM Analysis & Results

C0402C0G500-221JNE

Temperature /Humidity Storage

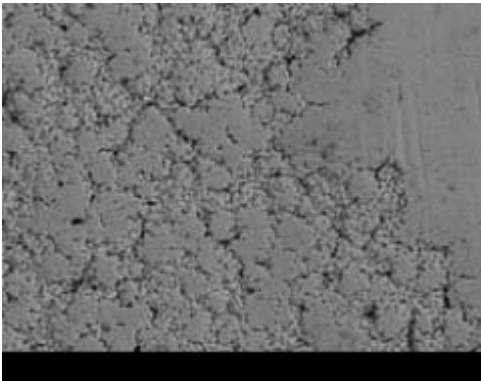


Temperature Cycling

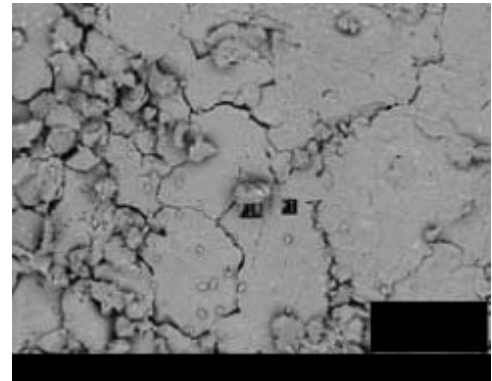


C0402X7R160-104KNE

Temperature /Humidity Storage

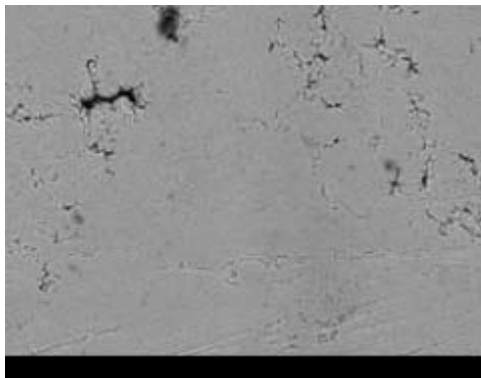


Temperature Cycling

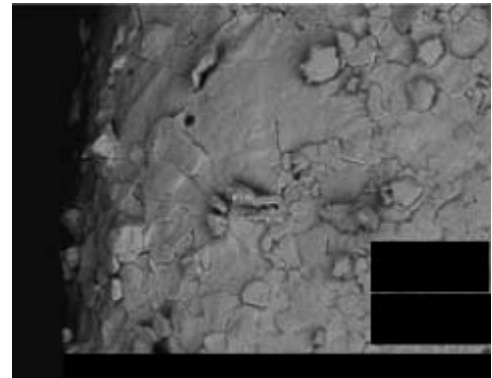


C0603Y5V250-104ZNE

Temperature /Humidity Storage



Temperature Cycling



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V. Conclusion

Conclusion:

Based on the results that were performed in these tests, it was concluded that no Tin Whiskers grew greater than 50um's for any of the SMT passives components that were tested. 50um's is the industry standard for maximum allowable length for Tin Whiskers and the results clearly show that over significant periods of time involving temperature & humidity storage, temperature cycling, and storage at room temperature of this type of SMT passive components, Tin Whiskers will not typically grow over 30um's for MLCC's. Tin Whiskers can certainly be grown in excess of 50um's for this type of SMT passives when they are exposed to certain and specific environmental conditions such as low DC bias (1.5V DC), high humidity (>80 % R.H), and higher atmospheric pressures. However, Tin Whiskers will not grow or have not been seen to grow in excess of 50um's when they are subjected to a standard re-flow process typically associated with this type of SMT passive components. While tests conducted by others may yield different results, Venkel did not observe any Tin Whisker growth in excess of 50um's and hence we believe are not a major concern when processing these types of SMT passive components.

Please contact the engineering department at Venkel Ltd. if any additional information is required or specific topics need to be discussed regarding these reports.