



Syfer Technology Limited, Old Stoke Road,  
Arminghall, Norwich, Norfolk, NR14 8SQ,  
United Kingdom  
Tel: +44 (0) 1603 723300  
Tel. (Sales): 01603 723310  
Fax: +44 (0) 1603 723301  
Email: [sales@syfer.co.uk](mailto:sales@syfer.co.uk)  
Web: [www.syfer.com](http://www.syfer.com)

## **IPC/JEDEC J-STD-020D Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices**

### **Syfer Surface Mount Capacitor Test Results**

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## 1. Introduction

The purpose of J-STD-020 is to identify the moisture sensitivity classification level of nonhermetic solid state surface mount devices (SMDs). The classification level enables proper packaging, storage and handled to prevent potential damage as a result of moisture-induced stress during soldering operations and/ or repair operations.

Moisture Sensitivity Levels defined by J-STD-020

Level	Floor Life	
	Time	Condition
1 <sup>(1)</sup>	Unlimited <sup>(2)</sup>	≤30°C/ 85%RH
2	1 year	≤30°C/ 60%RH
2a	4 weeks	≤30°C/ 60%RH
3	168 hours	≤30°C/ 60%RH
4	72 hours	≤30°C/ 60%RH
5	48 hours	≤30°C/ 60%RH
5a	24 hours	≤30°C/ 60%RH
6	Time On Label (TOL)	≤30°C/ 60%RH

Notes:

- (1) If a device passes level 1, it is classified as not being moisture sensitive and does not require dry pack.
- (2) Unlimited floor life refers specifically to moisture sensitivity related to components cracking during soldering operations. Other factors may affect, for example, component solderability. Syfer recommended shelf life and storage conditions are available at [www.syfer.com](http://www.syfer.com)

Copies of J-STD-020 are available at <http://www.jedec.org>

## 2. Moisture Sensitivity Classification Process

### 2.1 Initial Electrical Test

Capacitors tested for:

- Capacitance.
- Dissipation Factor.
- Insulation resistance.
- Dielectric Withstand Voltage.



## 2.2 Initial Visual

Capacitors externally visually examined using 50x magnification.

## 2.3 Bake

Capacitors subjected to minimum 24hours at 125°C +5/-0°C.

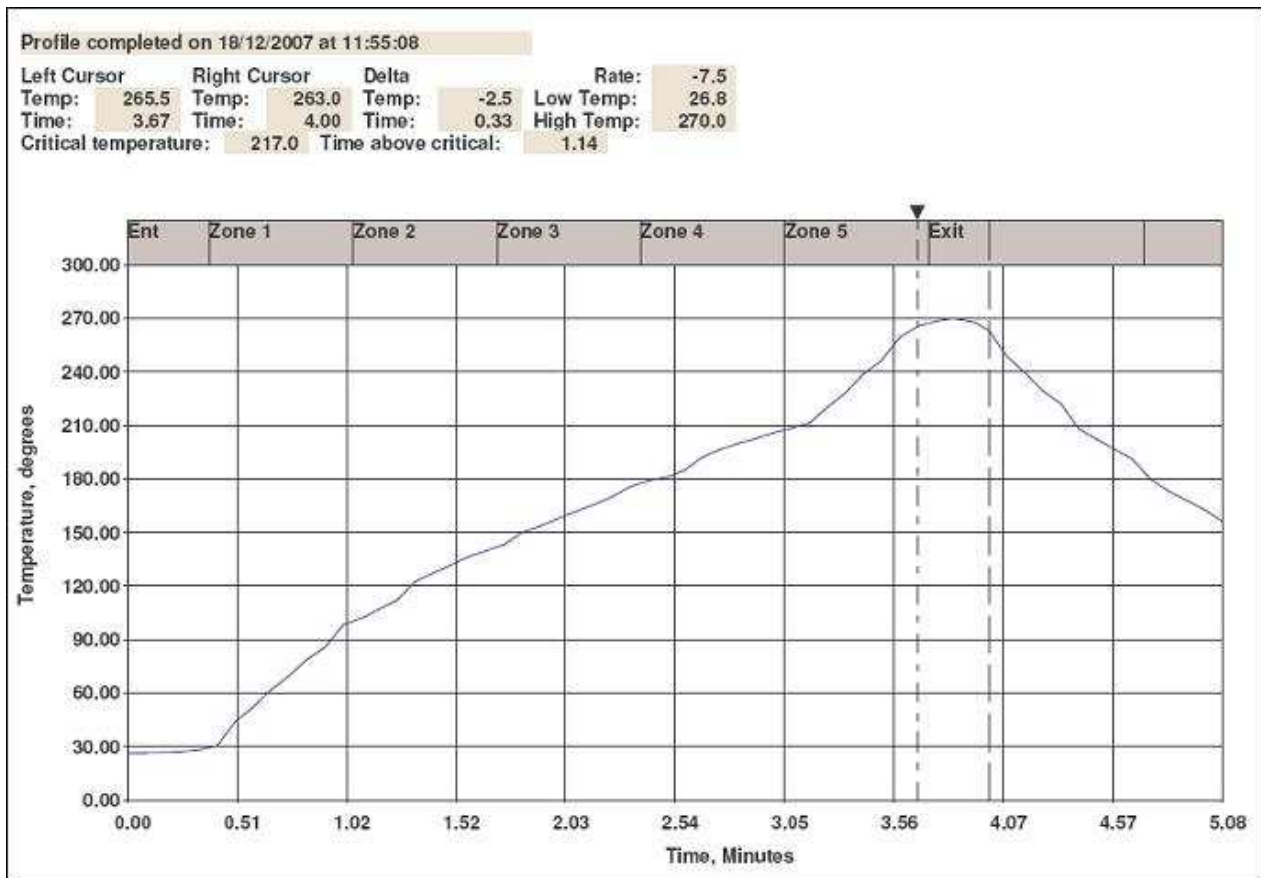
## 2.4 Moisture Soak

Capacitors placed in a humidity chamber at 85°C/ 85%RH for 168 hours.

## 2.5 Reflow x 3

Within 15 minutes to maximum 4 hours after the moisture soak, capacitors subjected to 3x reflow soldering profile.

Reflow soldering profile used by Syfer:



## 2.6 Final External Visual

Capacitors externally visually examined using 50x magnification.

## 2.7 Final Electrical Test

Capacitors tested for:

- Capacitance.
- Dissipation Factor.
- Insulation resistance.
- Dielectric Withstand Voltage.

## 2.8 Final Internal Visual Examination

J-STD-020 includes a final acoustic microscopy stage after the final electrical test with any component identified with a crack being evaluated by sectioning.

Acoustic microscopy may not identify all cracks within capacitors and to verify that no cracks are present, Syfer has sectioned all capacitors tested.

Sectioning is conducted by mounting capacitors in high edge retention potting compound and then grinding through the capacitors. During the grinding process, the capacitors have been frequently examined using upto 200x magnification checking for cracks.

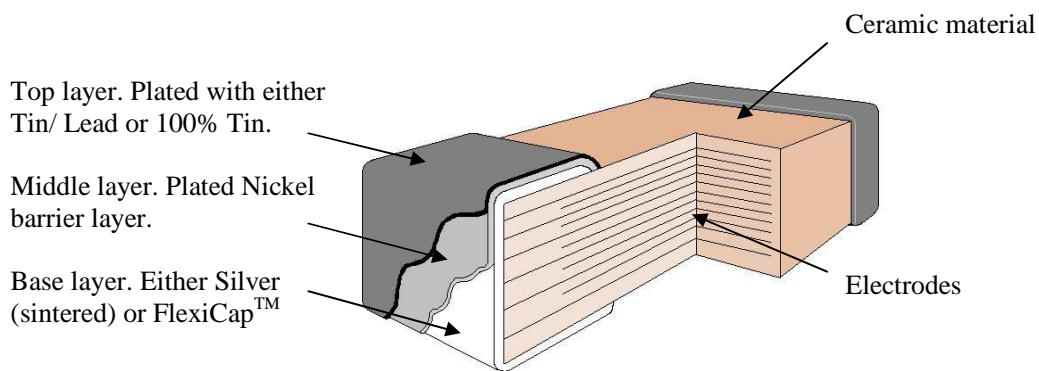


Fig. 1. Capacitor construction diagram

## 3. Failure Criteria

If 1 or more capacitor in the test sample fails then the whole family group is considered to have failed the tested MSL (Moisture Sensitivity Level).

A capacitor is considered to have failed if it exhibits any of the following after the 168 hour moisture soak and subsequent 3x reflow processes:

- Crack observed during the Final External Visual examination.
- Final Electrical Test failure.
- Crack observed during the Final Internal Visual examination.



#### 4. Syfer Test Summary

Moisture/ reflow sensitivity classification has been conducted by Syfer based on a family sampling approach in relation to:

- Capacitor case size.
- Dielectric classification.
- Termination type.

#### Results

Capacitor Case Size	Dielectric Type	Termination Type <sup>(1)</sup>	Sample Size	Pre Moisture Soak and 3x Reflow		Post Moisture Soak/ 3x Reflow			Appendix 1 Photo Ref
				2.1 Initial Electrical Tests	2.2 Initial Visual	2.6 Final External Visual	2.7 Final Electrical Tests	2.8 Internal Visual Examination	
0603	C0G	J	25	Pass	Pass	Pass	Pass	Pass	1 and 2
0603	X7R	J	25	Pass	Pass	Pass	Pass	Pass	3 and 4
0603	X7R	Y	25	Pass	Pass	Pass	Pass	Pass	5 and 6
1210	C0G	J	25	Pass	Pass	Pass	Pass	Pass	7 and 8
1210	X7R	J	25	Pass	Pass	Pass	Pass	Pass	9 and 10
1210	X7R	Y	25	Pass	Pass	Pass	Pass	Pass	11 and 12
2225	C0G	J	25	Pass	Pass	Pass	Pass	Pass	13 and 14
2225	X7R	J	25	Pass	Pass	Pass	Pass	Pass	15 and 16
2225	X7R	Y	25	Pass	Pass	Pass	Pass	Pass	17 and 18

Notes:

- (1) Termination type refers to the code letter used in Syfer part numbers.  
 J: Silver base with Nickel Barrier (100% matte tin Plating).  
 Y: **FlexiCap™** termination base with Ni Barrier (100% matte tin plating).

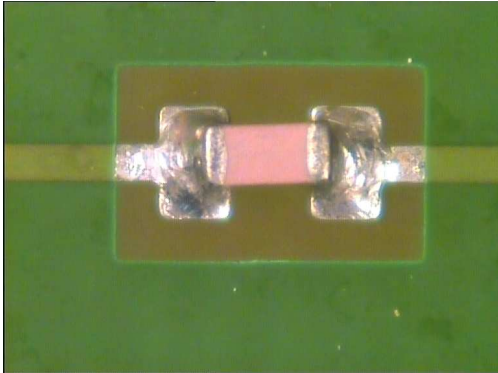
All capacitors tested passed Moisture Sensitivity Level (MSL) 1 and are not classified as being moisture sensitive. The capacitors supplied by Syfer do not require dry pack.

## Appendix 1 – Capacitor Photographs

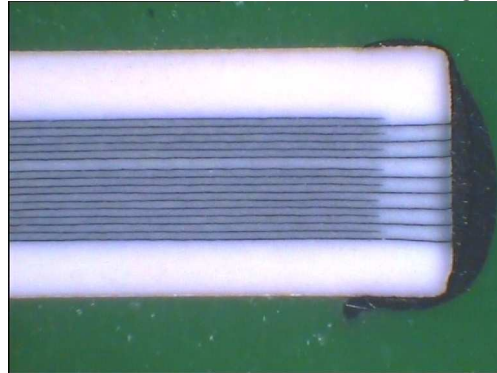
The following photographs have been taken after the moisture soak and 3x reflow processes and are representative of the capacitors subjected to the moisture/ reflow sensitivity classification tests.

0603 C0G J Termination

Ref 1. Final External Visual.

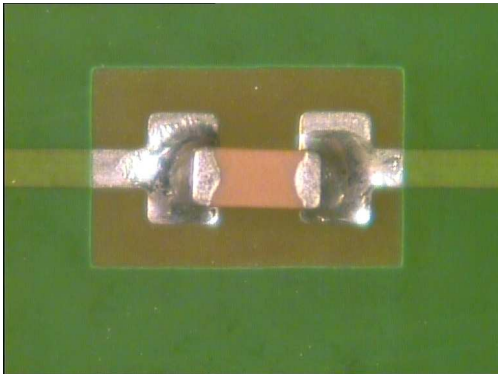


Ref 2. Final Internal Visual (100x mag)

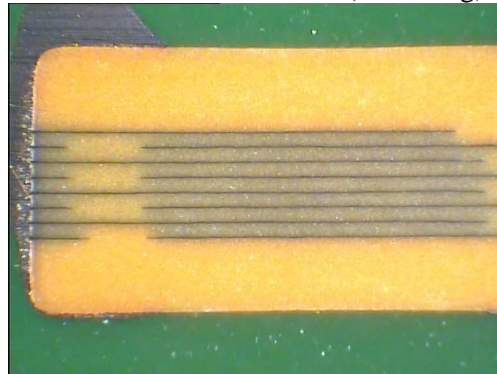


0603 X7R J Termination

Ref 3. Final External Visual.

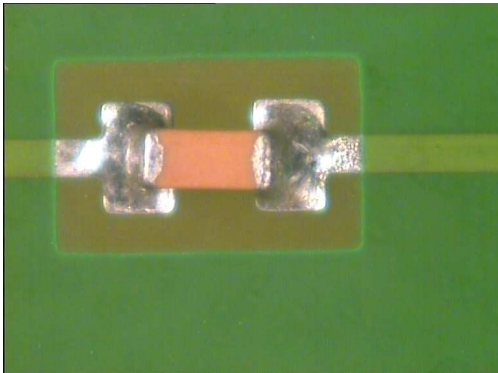


Ref 4. Final Internal Visual (100x mag)

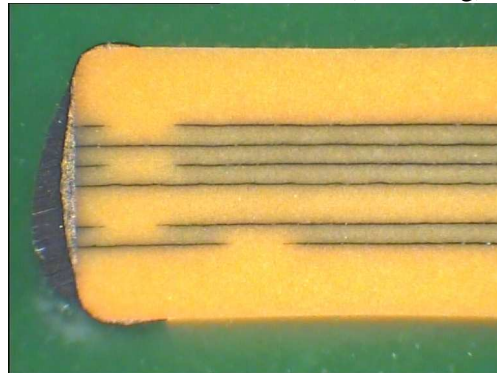


0603 X7R Y Termination

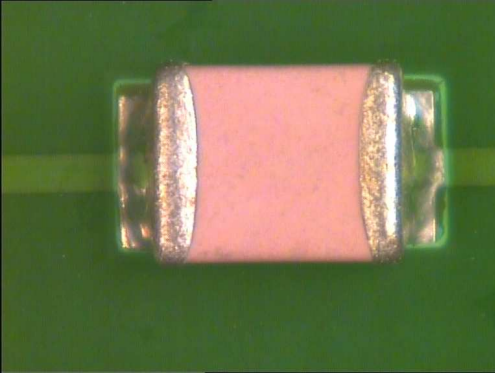
Ref 5. Final External Visual.



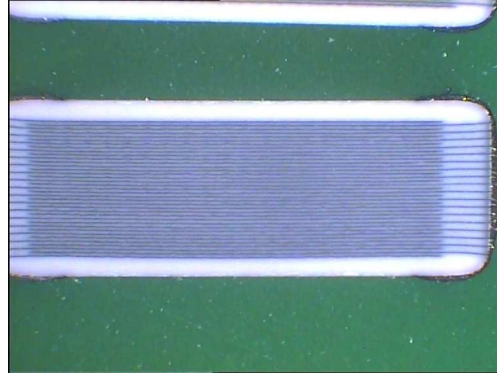
Ref 6. Final Internal Visual (100x mag)



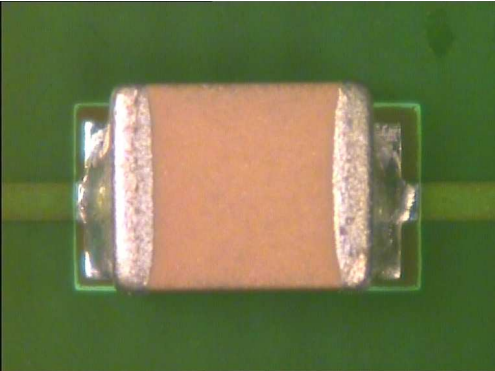
1210 C0G J Termination  
Ref 7. Final External Visual.



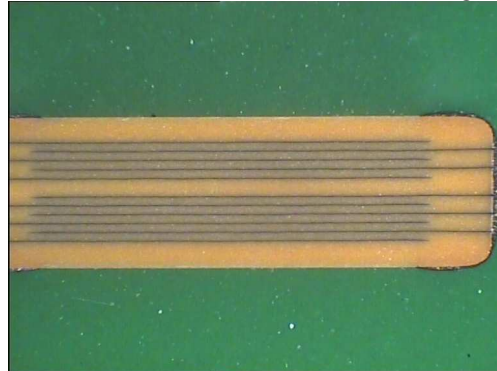
Ref 8. Final Internal Visual (50x mag)



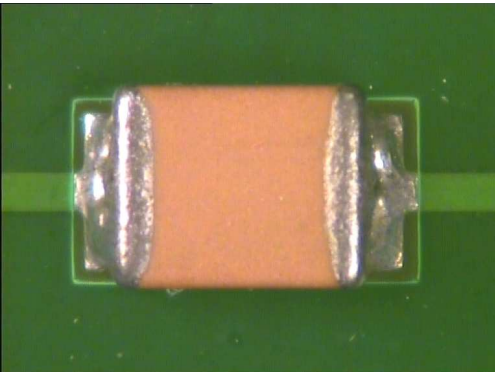
1210 X7R J Termination  
Ref 9. Final External Visual.



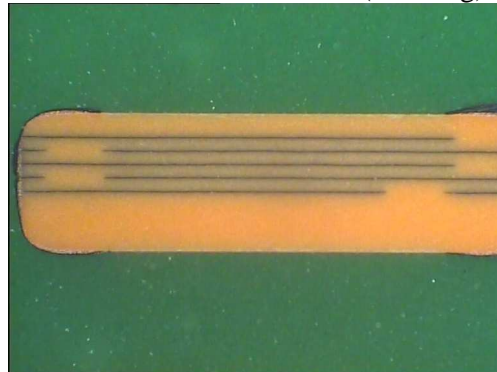
Ref 10. Final Internal Visual (50x mag)



1210 X7R Y Termination  
Ref 11. Final External Visual.

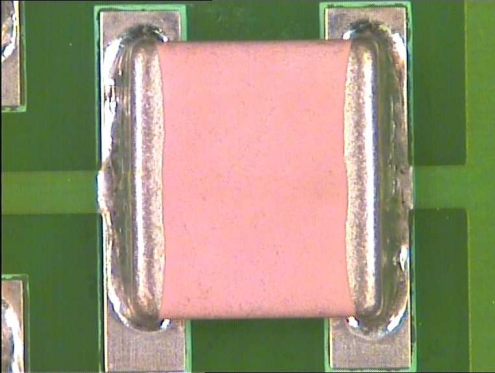


Ref 12. Final Internal Visual (50x mag)

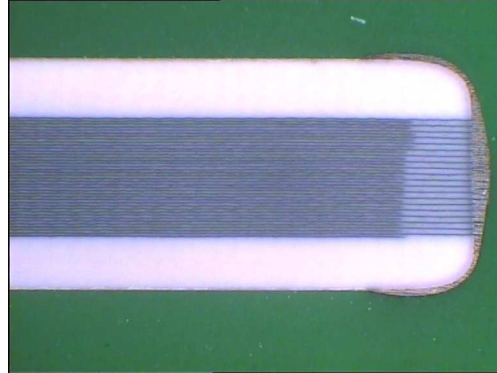


2225 C0G J Termination

Ref 13. Final External Visual.

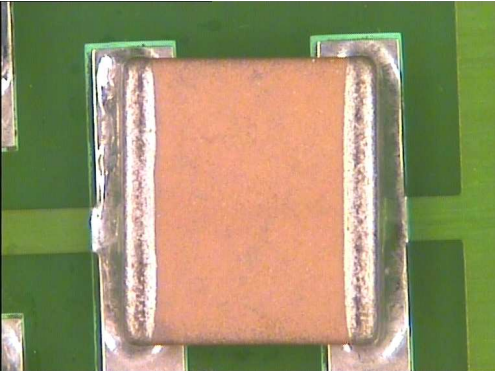


Ref 14. Final Internal Visual (50x mag)

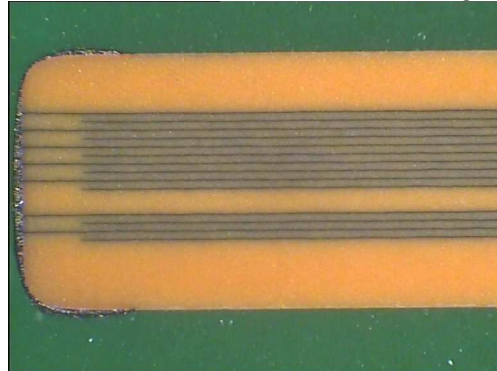


2225 X7R J Termination

Ref 15. Final External Visual.

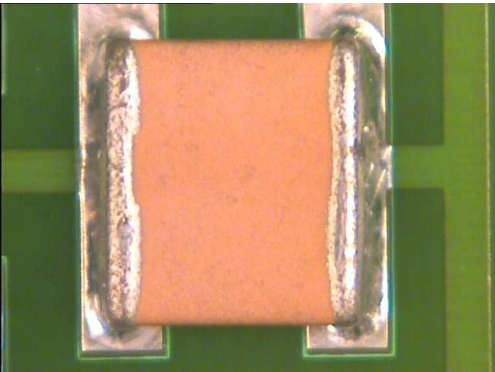


Ref 16. Final Internal Visual (50x mag)



2225 X7R Y Termination

Ref 17. Final External Visual.



Ref 18. Final Internal Visual (50x mag)

