# ALTERNATION HISTORY RECORDS 变更记录

| Date<br>日期 | Version<br>版本 | Mark<br>标记 | Page<br>页码 | Description<br>描述 | Drafter<br>制定者 | Approver<br>审批者 |
|---|---|---|---|---|---|---|
| 2025-04-05 | B | / | / | Release with a new version | Doris Chang | / |

# 1. Application

This specification applies to Multilayer Ceramic Capacitors Axial Leaded
Designed capacitor's quality meets IEC60384.

# 2. Part Number System

A X7R 103 K 1H R13 TA --

- A — Type(2.1)
- X7R — Dielectric（2.2）
- 103 — Capacitance (2.3)
- K — Tolerance (2.4)
- 1H — Voltage (2.5)
- R13 — Size (2.6)
- TA — Packaging (2.7)
- -- — Suffix(2.8)

## 2.1 Product Type

| Code | A |
|---|---|
| Type | Axial |

## 2.2 Dielectric

| Dielectric | Temperature Range | Capacitance Change |
|---|---|---|
| NPO | -55 ~ 125℃ | 0±30 ppm/℃ |
| X5R | -55 ~ 85℃ | ±15 % |
| X7R | -55 ~ 125℃ | ±15 % |

## 2.3 Capacitance code

| Code | 100 | 101 | 102 | 103 | 104 | XXX |
|---|---|---|---|---|---|---|
| Capacitance (pF) | 10 | 100 | 1000 | 10000 | 100000 | --- |

Remark:First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 100,000 pF as 104. (For values below 10pF use "R" in place of decimal point, e.g., 1R4 = 1.4pF

## 2.4 Capacitance tolerance

| Code | J | K | M | V | Z |
|---|---|---|---|---|---|
| Tolerance Range | ±5% | ±10% | ±20% | -10%~+20% | -20%~+80% |

2.5 **Rated voltage code**

| Code | 0J | 1A | 1C | 1E | 1V | 1H | 1J |
|---|---|---|---|---|---|---|---|
| Voltage (WV) | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 |
| **Code** | **2A** | **2C** | **2D** | **2E** | **2G** | **2W** | **2H** |
| Voltage (WV) | 100 | 160 | 200 | 250 | 400 | 450 | 500 |

2.6 **Size**

Check point 4

2.7 **Packaging**

| Code | Packing |
|---|---|
| TA | Ammo |
| TB | Ammo |
| TR | Reel |
| RR | Bulk |

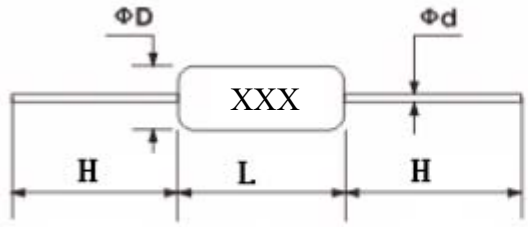
2.8 **Suffix: Inner Code**

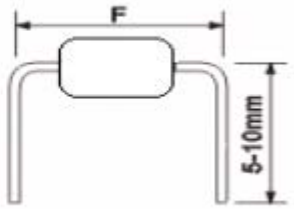
## 3 .Feature:

Miniature size, large capacitance, tape and reel packaging suitable for auto-placement
Epoxy resin coating creates excellent performance in humidity resistance, mechanical strength and heat resistance
Standard size, various lead configuration
Encapsulation meets flamability standard UL 94V–0

| Dielectric Type | Class I | Class II | |
|---|---|---|---|
| Dielectric Material | NPO/COG Temperature Compensating | X7R | X5R |
| Electrical Properties | The electrical properties is the most stable one and has little change with temperature, voltage and time. | X7R material has high dielectric constant, and its capacitance is higher than class I. These capacitors are classified as having a semi-stable T.C.. | The capacity varies greatly with the influence of temperature The capacitance is unstable and sensible to temperature and voltage. |
| Application | Used in applications where low-losses and high-stability are required, such as filters, oscillators, and timing circuits so on. | Used over a wide temperature range , such in these kinds of circuits, DC-blocking, coupling, bypassing, frequency discriminating etc. | Ideally suited for bypassing and coupling application circuits operating with low DC bias in the environment approaching to room temperature. |
| Capacitance range | 0.5pF~0.1uF | 100pF~47uF | 1nF~100uF |

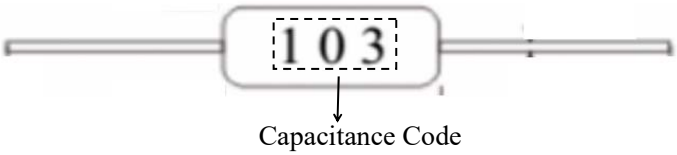
## 4. External Dimensions :




| Size Code | L(mm) | D(mm) | Φd(mm) | H(mm) | F(mm) ±0.6 | | |
|---|---|---|---|---|---|---|---|
| R13(0603) | 4.32Max | 2.54Max | 0.45±0.05 | ≥20 | 5.08 | 7.50 | 10.0 |
| R15(0805) | 4.32Max | 2.54Max | 0.45±0.05 | ≥20 | 5.08 | 7.50 | 10.0 |
| R18(1206) | 6.05Max | 3.05Max | 0.48±0.05 | ≥20 | 5.08 | 7.50 | 10.0 |
| | | | | | | | |

## 5. Marking:



## 6. Specifications:

<table>
<tr><th>No.</th><th>Item</th><th colspan="5">Test Method</th><th>Specification</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">Capacitance (C)</td><td rowspan="3">Class I</td><td>Capacitance</td><td>Measuring Frequency</td><td>Measuring Voltage</td><td colspan="2" rowspan="3">With in the specified tolerance</td></tr>
<tr><td>＜1000pF</td><td>1MHz±10%</td><td>0.5 to 5Vrms</td></tr>
<tr><td>≥1000pF</td><td>1KHz±10%</td><td>1±0.2Vrms</td></tr>
<tr><td>Class II</td><td colspan="4">Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour and then leave in ambient condition for 24±2 hours before measurement.<br>Capacitance | Measuring Frequency | Measuring Voltage<br>C≦10μF | 1KHz±10% | 1.0±0.2Vrms<br>C＞ 10μF | 120Hz±20% | 0.5±0.2Vrms</td><td colspan="2">With in the specified tolerance</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Dissipation Factor (DF) or Q</td><td rowspan="2">Class I</td><td>Capacitance</td><td>Measuring Frequency</td><td>Measuring Voltage</td><td colspan="2" rowspan="2">C≤ 30pF,Q ≥1000<br>C＞30pF,Q ≥ 400+20C<sub>R</sub></td></tr>
<tr><td>＜1000pF</td><td>1MHz±10%</td><td>0.5 to 5Vrms</td></tr>
<tr><td>Class II</td><td colspan="4">Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour and then leave in ambient condition for 24±2 hours before measurement.<br>Capacitance | Measuring Frequency | Measuring Voltage<br>C≤10μF | 1KHz±10% | 1.0±0.2Vrms<br>C＞ 10μF | 120Hz±20% | 0.5±0.2Vrms</td><td colspan="2">V<sub>R</sub> | C<sub>R</sub> | DF(%)<br>10V | ＜10uF | ≤10%<br>≥10uF | ≤15%<br>16V | ＜10uF | ≤7.5%<br>≥10uF | ≤15%<br>25V | ＜10uF | ≤5.5%<br>≥10uF | ≤10%<br>35V | ＜1uF | ≤5.5%<br>≥1uF | ≤10%<br>50V | ＜1uF | ≤3.5%<br>≥1uF | ≤5.5%<br>≥100V | ＜1uF | ≤2.5%<br>≥1uF | ≤3.5%</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Insulation Resistance</td><td>Class I</td><td colspan="4" rowspan="2">Measuring voltage：Rated voltage<br>Du ration:60±5s</td><td colspan="2">C<sub>R</sub> | IR<br>≤10nF | ≥10GΩ<br>＞10nF | ≥100/C<sub>R</sub> ΩF[1)]</td></tr>
<tr><td>Class II</td><td colspan="2">C<sub>R</sub> | IR<br>≤25nF | ≥4GΩ<br>＞25nF | ≥100/C<sub>R</sub>ΩF[1)]</td></tr>
</table>

Remark:

1) ≥100/$C_R$ Ω F "$C_R$" stands for product capacitance

For example:

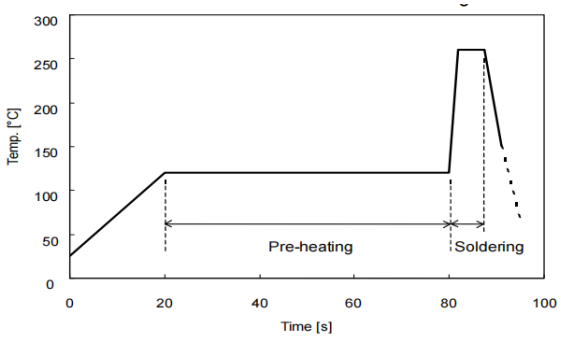
-AX7R104K1HR13TA (Ceramic Cap Axial,0603,X7R,50V,0.1uF,±10%)

IR≥100ΩF/$C_R$=100Ω F/(0.1*$10^{-6}$F)=$10^9$Ω=1GΩ

## 7.Reliability test conditions and requirements :

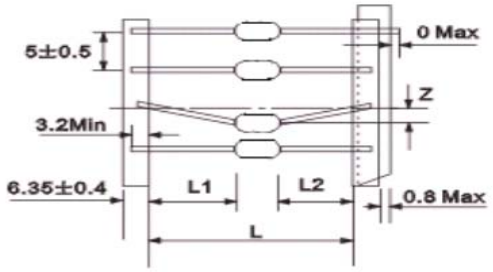
| No. | Test Item | Test Method (Ref. Standard:JIS C 5101 all parts 、IEC60384 all parts | Specification | | |
|---|---|---|---|---|---|
| 1 | Humidity Load | Apply the rated voltage at 40±2°C and relative humidity of 90 to 95% for 500+24/-0 hours.Remove and set for 24±2 hours *at room condition, then measure. (Charge/Discharge current ≤ 50mA) | Item | Class I | Class II |
| | | | Capacitance Change | ≤7.5% or ≤ 0.75pF Whichever is larger | ≤10% |
| | | | DF/Q | $C_R$≤ 30pF,Q ≥200 $C_R$＞30pF,Q ≥100+10/3$C_R$ | $C_R$≤ 0.1uF：≤12.5% 0.1uF＜$C_R$ ＜ 1uF：≤15.0% $C_R$≥1uF：≤17.5% |
| | | | IR | ≥ 500MΩ or 25/$C_R$ Ω.F Whichever is smaller | |
| | | | Appearance | No defects or abnormalities. | |
| 2 | Humidity Steady State | Set the capacitor at 40±2°C and relative humidity 90 to 95% for 500+24/-0 hours. Remove and set for 24±2 hours at *room condition, then measure. | Item | Class I | Class II |
| | | | Capacitance Change | ≤7.5% or ≤ 0.75pF Whichever is larger | ≤10% |
| | | | DF/Q | $C_R$＜10pF, Q≥200+10$C_R$ 10pF≤$C_R$≤30pF,Q≥275+2.5$C_R$ $C_R$＞30pF,Q≥350 | $C_R$≤ 0.1uF：≤12.5% 0.1uF＜$C_R$ ＜ 1uF：≤15.0% $C_R$≥1uF：≤17.5% |
| | | | IR | ≥ 500MΩ or 25/$C_R$ Ω.F Whichever is smaller | |
| | | | Appearance | No defects or abnormalities. | |
| 3 | High Temperature Load | Apply 150% of the rated voltage at the maximum operating temperature ±3°C for 1000+48/-0 hours. Remove and set for 24±2 hours at *room condition, then measure. (Charge/Discharge current≤50mA) | Item | Class I | Class II |
| | | | Capacitance Change | ≤7.5% or ≤ 0.75pF Whichever is larger | ≤10% |
| | | | DF/Q | $C_R$＜10pF, Q≥200+10$C_R$ 10pF≤$C_R$≤30pF,Q≥275+2.5$C_R$ $C_R$＞30pF,Q≥350 | $C_R$≤ 0.1uF：≤12.5% 0.1uF＜$C_R$ ＜ 1uF：≤15.0% $C_R$≥1uF：≤17.5% |
| | | | IR | ≥ 500MΩ or 25/$C_R$ Ω.F Whichever is smaller | |
| | | | Appearance | No defects or abnormalities. | |
| 4 | Resistance to Soldering Heat | The lead wires should be immersed in the melted solder 1.5 to 2.0mm from the root of terminal at 260±5°C for 10±1 seconds. Remark: After the experiment Class I:Capacitor should be stored for 24±2 hours at *room condition, Class II:Capacitor should be stored for 48±2 hours at room condition; | Item | Class I | Class II |
| | | | Capacitance Change | ≤2.5% or ≤ 0.25pF Whichever is larger | ≤10% |
| | | | Appearance | No defects or abnormalities. | |
| 5 | Soldering Iron | Temperature of iron-tip : 350±10°C Soldering time : 3.5±0.5 seconds Soldering iron wattage：60W max Soldering position Straight Lead : 1.5 to 2.0mm from the root of terminal. Crimp Lead : 1.5 to 2.0mm from the end of lead bend. Remark: After the experiment Class I:Capacitor should be stored for 24±2 hours at * room condition, Class II:Capacitor should be stored for 48±2 hours at room condition; | Item | Class I | Class II |
| | | | Capacitance Change | ≤2.5% or ≤ 0.25pF Whichever is larger | ≤10% |
| | | | Appearance | No defects or abnormalities. | |

*room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

<table>
<tr><th>No.</th><th>Test Item</th><th colspan="3">Test Method<br>Ref. Standard:JIS C 5101 all parts 、IEC60384 all parts</th><th>Specification</th></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Dielectric Strength</td><td colspan="2">Between Terminals</td><td>Terminal To External Resin</td><td rowspan="4">No defects or abnormalities.</td></tr>
<tr><td colspan="2">Duration：5±1s<br>Measuring Voltage:</td><td rowspan="3">The capacitor is placed in a container with metal balls of 1mm diameter so that each terminal, short-circuit, is kept approximately 2mm from the balls, and 250% of the rated DC voltage is impressed for 1 to 5 seconds between capacitor terminals and metal balls.<br>Remark:Charge/Discharge current ≦ 50mA</td></tr>
<tr><td>Class I</td><td>Class II</td></tr>
<tr><td>300% Rated voltage($3U_R$)<br>Remark:Charge/Discharge current ≦ 50mA</td><td>$U_R$≤500V,$2.5U_R$<br>500V＜ $U_R$≤1000V,$1.5U_R$<br>$U_R$＞1000V,$1.2U_R$<br>Remark:Charge/Discharge current ≤ 50mA,But small size(≤0603) ≤30mA</td></tr>
<tr><td>7</td><td>Bending Strength</td><td colspan="3">Each lead wire should be subjected to a force of 2.5N and then be bent 90° at the point of egress in one direction.<br>Each wire is then returned to the original position and bent 90° in the opposite direction at the rate of one bend per 2 to 3 seconds.</td><td>Termination not to be broken or loosened</td></tr>
<tr><td>8</td><td>Solvent Resistance</td><td colspan="3">The capacitor should be fully immersed, unagitated.in reagent at 20 to 25°C for 30+5 seconds and then remove gently.<br>Marking on the surface of the capacitor shall immediately be visually examined.</td><td>No defects or abnormalities in appearance and legible marking.</td></tr>
<tr><td>9</td><td>Solderability</td><td colspan="3">The terminal of capacitor is dipped into a solution of rosin ethanol (25% rosin in weight propotion).<br>Immerse in solder solution for 2±0.5 seconds.<br>In both cases the depth of dipping is up to about 1.5 to 2mm from the terminal body.<br>Temp. of solder : 245±5°C (Sn-3.0Ag-0.5Cu)</td><td>Solder is deposited on unintermittingly immersed portion in axial direction covering 3/4 or more in circumferential direction of lead wires.</td></tr>
<tr><td>10</td><td>Flow Soldering</td><td colspan="3">Soldering temperature : 260 ℃ max.<br>Soldering time : 7.5 s max.<br>Preheating temperature : 120 ℃ max.<br>Preheating time : 60 s max.<br>Remark:<br>Do not apply reflow soldering.<br>Standard Condition for Flow Soldering<br>  <br></td><td></td></tr>
</table>

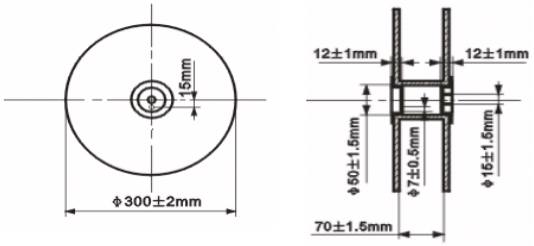
# 8.Taping specification and Reel Packaging

8.1 Taping specification

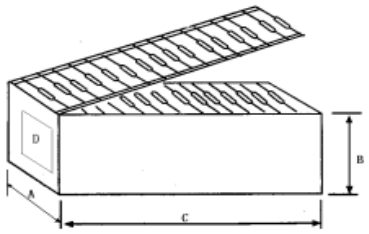



| Tape Code | L(mm) | Z(mm) | $L_1/L_2$(mm) |
|---|---|---|---|
| TA | 52±2 | 1.2 | ≥20 |
| TB | 26±1.5 | 0.8 | ≥20 |

8.2 Reel Packaging:




8.3 Ammo Packaging




| Size Code | Tape Code | A±5mm | B±5mm | C±5mm | D |
|---|---|---|---|---|---|
| R13 | TA | 76 | 72 | 263 | Lable |
| R13 | TB | 60 | 72 | 266 | |
| R15/R18 | TA | 83 | 80 | 266 | |
| R15/R18 | TB | 60 | 72 | 266 | |

8.4 Packaging Quantity:

| Size Code | Tape and Reel | Ammo | Bulk |
|---|---|---|---|
| R13 | 15000 | 5000 | 1000 |
| R15 | 15000 | 5000 | 1000 |
| R18 | 15000 | 5000 | 1000 |