# APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MT)

Qualified to AEC-Q200

0201 to 1210 Sizes (10V to 1000V)

X8G, NP0 & X7R Dielectrics

Halogen Free & RoHS Compliance



*Contents in this sheet are subject to change without prior notice.

## 1. DESCRIPTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

WTC's MT series MLCC is made by NP0,X7R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MT series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications.

## 2. FEATURES

a. A wide selection of sizes is available (0201 to 0805).
b. High capacitance in given case size.
c. Capacitor with lead-free termination (pure Tin).
d. The MT series meet AEC-Q200 requirement.

## 3. APPLICATIONS

a. For Navigation & Information equipments.
b. For entertainment equipments
c. For comfortable equipments.
d. For Automotive electronic equipment.

## 4. HOW TO ORDER

| MT | 18 | N | 102 | J | 500 | C | T |
|---|---|---|---|---|---|---|---|
| **Series** | **Size** | **Dielectric** | **Capacitance** | **Tolerance** | **Rated voltage** | **Termination** | **Packaging style** |
| **MT**= Automotive safe concern (with AEC-Q200 qualification) | **03**=0201 (0603)<br>**15**=0402 (1005)<br>**18**=0603 (1608)<br>**21**=0805 (2012)<br>**31=**1206 (3216)<br>**32**=1210 (3225) | **G**=X8G<br>**N**=NP0 (C0G)<br>**B**=X7R | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>102=10x10$^2$ =1000pF | **A**=±0.05pF<br>**B**=±0.1pF<br>**C**=±0.25pF<br>**D**=±0.5pF<br>**F**=±1%<br>**G**=±2%<br>**J**=±5%<br>**K**=±10%<br>**M**=±20% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>**100**=10 VDC<br>**160**=16 VDC<br>**250**=25 VDC<br>**500**=50 VDC<br>**101**=100 VDC<br>**201**=200 VDC<br>**251**=250 VDC<br>**501**=500 VDC<br>**631**=630 VDC<br>**102**=1000 VDC<br>**12E**=1250 VCD | **C**=Cu/Ni/Sn | **T**=7" reeled<br>**G**=13" reeled |

## 5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm) | W (mm) | T (mm)/Symbol | | Remark | $M_B$ (mm) |
|---|---|---|---|---|---|---|
| 0201 (0603) | 0.60±0.03 | 0.30±0.03 | 0.30±0.03 | L | # | 0.15±0.05 |
| 0402 (1005) | 1.00±0.05 | 0.50±0.05 | 0.50±0.05 | N | # | 0.25 +0.05/-0.10 |
| 0603 (1608) | 1.60±0.10 | 0.80±0.10 | 0.80±0.07 | S | | 0.40±0.15 |
| | 1.60 +0.15/-0.10 | 0.80 +0.15/-0.10 | 0.80 +0.15/-0.10 | X | | |
| 0805 (2012) | 2.00±0.15 | 1.25±0.10 | 0.60±0.10 | A | | 0.50±0.20 |
| | | | 0.80±0.10 | B | | |
| | | | 1.25±0.10 | D | # | |
| | 2.00±0.20 | 1.25±0.20 | 1.25±0.20 | I | # | |
| 1206 (3216) | 3.20±0.15 | 1.60±0.15 | 0.80±0.10 | B | | 0.60±0.20 |
| | | | 0.95±0.10 | C | | |
| | | | 1.25±0.10 | D | # | |
| | 3.20±0.20 | | 1.15±0.15 | J | # | |
| | | 1.60±0.20 | 1.60±0.20 | G | # | |
| | 3.20+0.3/-0.1 3.30+0.3/-0.1* | 1.60+0.3/-0.1 | 1.60+0.30/-0.10 | P | # | |
| 1210 (3225) | 3.20±0.30 | 2.50±0.20 | 0.95±0.10 | C | # | 0.75±0.25 |
| | | | 1.25±0.10 | D | # | |
| | 3.20±0.40 | 2.50±0.30 | 1.60±0.20 | G | # | |
| | | | 2.00±0.20 | K | # | |
| | 3.30±0.40*** | | 2.50±0.30 | M | # | |
| | 3.20±0.60** | 2.50±0.50** | 2.50±0.50** | | | |

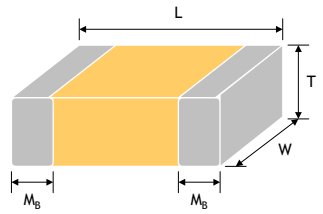

Fig. 1 The outline of MLCC

# Reflow soldering only is recommended.
* For MT31(100V)/Cap≧0.27μF;MT31(25V&50V)/Cap≧2.7μF products.
** For 1210(200V & 250V)/Cap>0.47μF
***For 1210 / NP0 / 1250V / Cap=10nF

## 6. GENERAL ELECTRICAL DATA*

| Dielectric | X8G | NP0 | X7R |
|---|---|---|---|
| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | |
| Capacitance range* | 0.1pF to 0.015uF | 0.1pF to 0.047uF | 100pF to 10μF |
| Capacitance tolerance** | Cap≤5pF[#1]: A (±0.05pF ), B (±0.1pF), C (±0.25pF)<br>5pF<Cap<10pF[#1]: A (±0.05pF),B (±0.1pF) , C (±0.25pF) ,D (±0.5pF)<br>Cap≥10pF: F (±1%), G (±2%), J (±5%) | | J (±5%), K (±10%), M (±20%) |
| Rated voltage (WVDC) | 10V, 16V, 25V, 50V, 100V | 10V, 16V, 25V, 50V, 100V, 200V, 250, 500, 630, 1000 ,1250 | |
| Operating temperature | -55 to +150°C | -55 to +125°C | |
| Capacitance characteristic | ±30ppm/°C | | ±15% |
| Termination | Ni/Sn (lead-free termination) | | |

#1: X8G/NP0, 0.1pF product only provide B tolerance and 5pF<Cap<10pF products need to check with sales if it can supply A (±0.05pF).
* Measured at the condition of 30~70% related humidity.
X8G/NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature
X7R: Please refer to page 13 “Reliability test conditions and requirements” for detail.
** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

# 7. CAPACITANCE RANGE

## X8G Dielectric

| DIELECTRIC | | X8G | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0402 | | | | 0603 | | | | 0805 | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 0.1pF (0R1) | N | N | N | N | | | | | | | | | |
| | 0.2pF (0R2) | N | N | N | N | | | | | | | | | |
| | 0.3pF (0R3) | N | N | N | N | | | | | | | | | |
| | 0.4pF (0R4) | N | N | N | N | | | | | | | | | |
| | 0.5pF (0R5) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 1.0pF (1R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 1.2pF (1R2) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 1.5pF (1R5) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 1.8pF (1R8) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 2.0pF (2R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 2.2pF (2R2) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 2.7pF (2R7) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 3.0pF (3R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 3.3pF (3R3) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 3.9pF (3R9) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 4.0pF (4R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 4.7pF (4R7) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 5.0pF (5R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 5.6pF (5R6) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 6.0pF (6R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 6.8pF (6R8) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 7.0pF (7R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 8.0pF (8R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 8.2pF (8R2) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 9.0pF (9R0) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 10pF (100) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 12pF (120) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 15pF (150) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 18pF (180) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 22pF (220) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 27pF (270) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 33pF (330) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 39pF (390) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 47pF (470) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 56pF (560) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 68pF (680) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 82pF (820) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 100pF (101) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 120pF (121) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 150pF (151) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 180pF (181) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 220pF (221) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 270pF (271) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 330pF (331) | N | N | N | N | S | S | S | S | A | A | A | A | A |
| | 390pF (391) | N | N | N | N | S | S | S | S | B | B | B | B | B |
| | 470pF (471) | N | N | N | N | S | S | S | S | B | B | B | B | B |
| | 560pF (561) | N | N | N | N | S | S | S | S | B | B | B | B | B |
| | 680pF (681) | N | N | N | N | S | S | S | S | B | B | B | B | B |
| | 820pF (821) | N | N | N | N | S | S | S | S | B | B | B | B | B |
| | 1,000pF (102) | N | N | N | N | S | S | S | S | B | B | B | B | B |
| | 1,200pF (122) | | | | | X | X | X | X | B | B | B | B | B |
| | 1,500pF (152) | | | | | X | X | X | X | B | B | B | B | B |
| | 1,800pF (182) | | | | | X | X | X | X | B | B | B | B | B |
| | 2,200pF (222) | | | | | X | X | X | X | B | B | B | B | B |
| | 2,700pF (272) | | | | | X | X | X | X | D | D | D | D | D |
| | 3,300pF (332) | | | | | X | X | X | X | D | D | D | D | D |
| | 3,900pF (392) | | | | | | | | | D | D | D | D | D |
| | 4,700pF (472) | | | | | | | | | D | D | D | D | D |
| | 5,600pF (562) | | | | | | | | | D | D | D | D | |
| | 6,800pF (682) | | | | | | | | | D | D | D | D | |
| | 8,200pF (822) | | | | | | | | | D | D | D | D | |
| | 0.010uF (103) | | | | | | | | | D | D | D | D | |

* X8G: 0.1pF product only provide B tolerance
1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

## X8G Dielectric

| DIELECTRIC | | X8G | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1206 | | | | 1210 | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | |
| Capacitance | 1.0pF (1R0) | | | | | | | | | |
| | 1.2pF (1R2) | B | B | B | B | | | | | |
| | 1.5pF (1R5) | B | B | B | B | | | | | |
| | 1.8pF (1R8) | B | B | B | B | | | | | |
| | 2.0pF (2R0) | B | B | B | B | | | | | |
| | 2.2pF (2R2) | B | B | B | B | | | | | |
| | 2.7pF (2R7) | B | B | B | B | | | | | |
| | 3.0pF (3R0) | B | B | B | B | | | | | |
| | 3.3pF (3R3) | B | B | B | B | | | | | |
| | 3.9pF (3R9) | B | B | B | B | | | | | |
| | 4.0pF (4R0) | B | B | B | B | | | | | |
| | 4.7pF (4R7) | B | B | B | B | | | | | |
| | 5.0pF (5R0) | B | B | B | B | | | | | |
| | 5.6pF (5R6) | B | B | B | B | | | | | |
| | 6.0pF (6R0) | B | B | B | B | | | | | |
| | 6.8pF (6R8) | B | B | B | B | | | | | |
| | 7.0pF (7R0) | B | B | B | B | | | | | |
| | 8.0pF (8R0) | B | B | B | B | | | | | |
| | 8.2pF (8R2) | B | B | B | B | | | | | |
| | 9.0pF (9R0) | B | B | B | B | | | | | |
| | 10pF (100) | B | B | B | B | C | C | C | C | C |
| | 12pF (120) | B | B | B | B | C | C | C | C | C |
| | 15pF (150) | B | B | B | B | C | C | C | C | C |
| | 18pF (180) | B | B | B | B | C | C | C | C | C |
| | 22pF (220) | B | B | B | B | C | C | C | C | C |
| | 27pF (270) | B | B | B | B | C | C | C | C | C |
| | 33pF (330) | B | B | B | B | C | C | C | C | C |
| | 39pF (390) | B | B | B | B | C | C | C | C | C |
| | 47pF (470) | B | B | B | B | C | C | C | C | C |
| | 56pF (560) | B | B | B | B | C | C | C | C | C |
| | 68pF (680) | B | B | B | B | C | C | C | C | C |
| | 82pF (820) | B | B | B | B | C | C | C | C | C |
| | 100pF (101) | B | B | B | B | C | C | C | C | C |
| | 120pF (121) | B | B | B | B | C | C | C | C | C |
| | 150pF (151) | B | B | B | B | C | C | C | C | C |
| | 180pF (181) | B | B | B | B | C | C | C | C | C |
| | 220pF (221) | B | B | B | B | C | C | C | C | C |
| | 270pF (271) | B | B | B | B | C | C | C | C | C |
| | 330pF (331) | B | B | B | B | C | C | C | C | C |
| | 390pF (391) | B | B | B | B | C | C | C | C | C |
| | 470pF (471) | B | B | B | B | C | C | C | C | C |
| | 560pF (561) | B | B | B | B | C | C | C | C | C |
| | 680pF (681) | B | B | B | B | C | C | C | C | C |
| | 820pF (821) | B | B | B | B | C | C | C | C | C |
| | 1,000pF (102) | B | B | B | B | C | C | C | C | C |
| | 1,200pF (122) | B | B | B | B | C | C | C | C | C |
| | 1,500pF (152) | B | B | B | B | C | C | C | C | C |
| | 1,800pF (182) | B | B | B | B | C | C | C | C | C |
| | 2,200pF (222) | B | B | B | B | C | C | C | C | C |
| | 2,700pF (272) | B | B | B | B | C | C | C | C | C |
| | 3,300pF (332) | B | B | B | B | C | C | C | C | C |
| | 3,900pF (392) | B | B | B | B | C | C | C | C | C |
| | 4,700pF (472) | B | B | B | B | C | C | C | C | C |
| | 5,600pF (562) | B | B | B | B | C | C | C | C | C |
| | 6,800pF (682) | C | C | C | C | C | C | C | C | C |
| | 8,200pF (822) | D | D | D | D | C | C | C | C | C |
| | 0.010μF (103) | D | D | D | D | C | C | C | C | C |
| | 0.012μF (123) | | | | | D | D | D | D | D |
| | 0.015μF (153) | | | | | D | D | D | D | D |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

## NP0 Dielectric

| DIELECTRIC | | NP0 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0201 | | | | | 0402 | | | | | 0603 | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 | 200 | 250 |
| Capacitance | 0.1pF (0R1) | L | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.2pF (0R2) | L | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.3pF (0R3) | L | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.4pF (0R4) | L | L | L | L | L | N | N | N | N | N | | | | | | | |
| | 0.5pF (0R5) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.6pF (0R6) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.7pF (0R7) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.8pF (0R8) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 0.9pF (0R9) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.0pF (1R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.2pF (1R2) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.5pF (1R5) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 1.8pF (1R8) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 2.0pF (2R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 2.2pF (2R2) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 2.7pF (2R7) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 3.0pF (3R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 3.3pF (3R3) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 3.9pF (3R9) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 4.0pF (4R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 4.7pF (4R7) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 5.0pF (5R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 5.6pF (5R6) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 6.0pF (6R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 6.8pF (6R8) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 7.0pF (7R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 8.0pF (8R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 8.2pF (8R2) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 9.0pF (9R0) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 10pF (100) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 12pF (120) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 15pF (150) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 18pF (180) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 22pF (220) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 27pF (270) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 33pF (330) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 39pF (390) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 47pF (470) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 56pF (560) | L | L | L | L | L | N | N | N | N | N | S | S | S | S | S | S | S |
| | 68pF (680) | L | L | L | L | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 82pF (820) | L | L | L | L | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 100pF (101) | L | L | L | L | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 120pF (121) | L | L | L | L | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 150pF (151) | | | | | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 180pF (181) | | | | | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 220pF (221) | | | | | | N | N | N | N | N | S | S | S | S | S | S | S |
| | 270pF (271) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 330pF (331) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 390pF (391) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 470pF (471) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 560pF (561) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 680pF (681) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 820pF (821) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 1,000pF (102) | | | | | | N | N | N | N | | S | S | S | S | S | X | X |
| | 1,200pF (122) | | | | | | | | | | | X | X | X | X | X | X | X |
| | 1,500pF (152) | | | | | | | | | | | X | X | X | X | X | X | X |
| | 1,800pF (182) | | | | | | | | | | | X | X | X | X | X | X | X |
| | 2,200pF (222) | | | | | | | | | | | X | X | X | X | X | | |
| | 2,700pF (272) | | | | | | | | | | | X | X | X | X | X | | |
| | 3,300pF (332) | | | | | | | | | | | X | X | X | X | X | | |
| | 3,900pF (392) | | | | | | | | | | | X | X | X | X | X | | |
| | 4,700pF (472) | | | | | | | | | | | X | X | X | X | X | | |
| | 5,600pF (562) | | | | | | | | | | | X | X | X | X | X | | |
| | 6,800pF (682) | | | | | | | | | | | X | X | X | X | X | | |
| | 8,200pF (822) | | | | | | | | | | | X | X | X | X | X | | |
| | 0.01μF (103) | | | | | | | | | | | X | X | X | X | X | | |

* NP0, 0.1pF product only provide B tolerance.

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## NP0 Dielectric

| DIELECTRIC | | NP0 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0805 | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 |
| Capacitance | 0.5pF (0R5) | A | A | A | A | A | A | A | A | A |
| | 0.6pF (0R6) | A | A | A | A | A | A | A | A | A |
| | 0.7pF (0R7) | A | A | A | A | A | A | A | A | A |
| | 0.8pF (0R8) | A | A | A | A | A | A | A | A | A |
| | 0.9pF (0R9) | A | A | A | A | A | A | A | A | A |
| | 1.0pF (1R0) | A | A | A | A | A | A | A | A | A |
| | 1.2pF (1R2) | A | A | A | A | A | A | A | A | A |
| | 1.5pF (1R5) | A | A | A | A | A | A | A | A | A |
| | 1.8pF (1R8) | A | A | A | A | A | A | A | A | A |
| | 2.2pF (2R2) | A | A | A | A | A | A | A | A | A |
| | 2.7pF (2R7) | A | A | A | A | A | A | A | A | A |
| | 3.3pF (3R3) | A | A | A | A | A | A | A | A | A |
| | 3.9pF (3R9) | A | A | A | A | A | A | A | A | A |
| | 4.7pF (4R7) | A | A | A | A | A | A | A | A | A |
| | 5.6pF (5R6) | A | A | A | A | A | A | A | A | A |
| | 6.8pF (6R8) | A | A | A | A | A | A | A | A | A |
| | 8.2pF (8R2) | A | A | A | A | A | A | A | A | A |
| | 10pF (100) | A | A | A | A | A | A | A | A | A |
| | 12pF (120) | A | A | A | A | A | A | A | A | A |
| | 15pF (150) | A | A | A | A | A | A | A | A | A |
| | 18pF (180) | A | A | A | A | A | A | A | A | A |
| | 22pF (220) | A | A | A | A | A | A | A | A | A |
| | 27pF (270) | A | A | A | A | A | A | A | A | A |
| | 33pF (330) | A | A | A | A | A | A | A | A | A |
| | 39pF (390) | A | A | A | A | A | A | A | A | A |
| | 47pF (470) | A | A | A | A | A | A | A | A | A |
| | 56pF (560) | A | A | A | A | A | A | A | A | A |
| | 68pF (680) | A | A | A | A | A | A | A | A | A |
| | 82pF (820) | A | A | A | A | A | A | A | B | B |
| | 100pF (101) | A | A | A | A | A | B | B | B | B |
| | 120pF (121) | A | A | A | A | A | B | B | D | D |
| | 150pF (151) | A | A | A | A | A | D | D | D | D |
| | 180pF (181) | A | A | A | A | A | D | D | D | D |
| | 220pF (221) | A | A | A | A | A | D | D | D | D |
| | 270pF (271) | A | A | A | A | A | D | D | D | D |
| | 330pF (331) | A | A | A | A | A | D | D | D | D |
| | 390pF (391) | B | B | B | B | B | D | D | D | D |
| | 470pF (471) | B | B | B | B | B | D | D | I | I |
| | 560pF (561) | B | B | B | B | B | D | D | I | I |
| | 680pF (681) | B | B | B | B | B | D | D | I | I |
| | 820pF (821) | B | B | B | B | B | D | D | I | I |
| | 1,000pF (102) | B | B | B | B | B | D | D | I | I |
| | 1,200pF (122) | B | B | B | B | B | D | D | I | I |
| | 1,500pF (152) | B | B | B | B | B | D | D | I | I |
| | 1,800pF (182) | B | B | B | B | B | D | D | I | I |
| | 2,200pF (222) | B | B | B | B | B | D | D | I | I |
| | 2,700pF (272) | D | D | D | D | D | I | I | | |
| | 3,300pF (332) | D | D | D | D | D | I | I | | |
| | 3,900pF (392) | D | D | D | D | D | I | I | | |
| | 4,700pF (472) | D | D | D | D | D | I | I | | |
| | 5,600pF (562) | D | D | D | D | D | | | | |
| | 6,800pF (682) | D | D | D | D | D | | | | |
| | 8,200pF (822) | D | D | D | D | D | | | | |
| | 0.01μF (103) | D | D | D | D | D | | | | |
| | 0.012μF (123) | D | D | D | D | D | | | | |
| | 0.015μF (153) | D | D | D | D | D | | | | |
| | 0.018μF (183) | D | D | D | D | D | | | | |
| | 0.022μF (223) | D | D | D | D | D | | | | |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

## NP0 Dielectric

| DIELECTRIC | | NP0 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1206 | | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 |
| Capacitance | 1.0pF (1R0) | | | | | | | | | | |
| | 1.2pF (1R2) | B | B | B | B | B | B | B | B | B | |
| | 1.5pF (1R5) | B | B | B | B | B | B | B | B | B | B |
| | 1.8pF (1R8) | B | B | B | B | B | B | B | B | B | B |
| | 2.2pF (2R2) | B | B | B | B | B | B | B | B | B | B |
| | 2.7pF (2R7) | B | B | B | B | B | B | B | B | B | B |
| | 3.3pF (3R3) | B | B | B | B | B | B | B | B | B | B |
| | 3.9pF (3R9) | B | B | B | B | B | B | B | B | B | B |
| | 4.7pF (4R7) | B | B | B | B | B | B | B | B | B | B |
| | 5.6pF (5R6) | B | B | B | B | B | B | B | B | B | B |
| | 6.8pF (6R8) | B | B | B | B | B | B | B | B | B | B |
| | 8.2pF (8R2) | B | B | B | B | B | B | B | B | B | B |
| | 10pF (100) | B | B | B | B | B | B | B | B | B | B |
| | 12pF (120) | B | B | B | B | B | B | B | B | B | B |
| | 15pF (150) | B | B | B | B | B | B | B | B | B | B |
| | 18pF (180) | B | B | B | B | B | B | B | B | B | B |
| | 22pF (220) | B | B | B | B | B | B | B | B | B | D |
| | 27pF (270) | B | B | B | B | B | B | B | B | B | D |
| | 33pF (330) | B | B | B | B | B | B | B | B | B | D |
| | 39pF (390) | B | B | B | B | B | B | B | B | B | D |
| | 47pF (470) | B | B | B | B | B | B | B | B | B | D |
| | 56pF (560) | B | B | B | B | B | B | B | B | B | D |
| | 68pF (680) | B | B | B | B | B | B | B | B | B | D |
| | 82pF (820) | B | B | B | B | B | B | B | B | B | D |
| | 100pF (101) | B | B | B | B | B | B | B | B | B | D |
| | 120pF (121) | B | B | B | B | B | B | B | B | B | D |
| | 150pF (151) | B | B | B | B | B | B | B | B | B | D |
| | 180pF (181) | B | B | B | B | B | B | B | B | B | G |
| | 220pF (221) | B | B | B | B | B | B | B | B | B | G |
| | 270pF (271) | B | B | B | B | B | B | C | C | C | G |
| | 330pF (331) | B | B | B | B | B | B | C | C | C | G |
| | 390pF (391) | B | B | B | B | B | B | C | C | C | G |
| | 470pF (471) | B | B | B | B | B | C | C | C | C | G |
| | 560pF (561) | B | B | B | B | B | C | D | D | D | G |
| | 680pF (681) | B | B | B | B | B | C | D | D | D | G |
| | 820pF (821) | B | B | B | B | B | C | G | G | G | G |
| | 1,000pF (102) | B | B | B | B | B | C | G | G | G | G |
| | 1,200pF (122) | B | B | B | B | B | C | G | G | G | |
| | 1,500pF (152) | B | B | B | B | B | D | G | G | G | |
| | 1,800pF (182) | B | B | B | B | B | D | G | G | G | |
| | 2,200pF (222) | B | B | B | B | B | D | G | G | G | |
| | 2,700pF (272) | B | B | B | B | B | D | G | G | G | |
| | 3,300pF (332) | B | B | B | B | B | D | G | G | G | |
| | 3,900pF (392) | B | B | B | B | B | D | G | G | G | |
| | 4,700pF (472) | B | B | B | B | B | D | G | G | G | |
| | 5,600pF (562) | B | B | B | B | B | G | G | G | G | |
| | 6,800pF (682) | C | C | C | C | C | G | G | G | G | |
| | 8,200pF (822) | D | D | D | D | D | G | G | G | G | |
| | 0.01μF (103) | D | D | D | D | D | G | G | G | G | |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## NP0 Dielectric

| DIELECTRIC | | NP0 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1210 | | | | | | | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 1000 | 1250 |
| Capacitance | 10pF (100) | C | C | C | C | C | C | C | C | C | C | |
| | 12pF (120) | C | C | C | C | C | C | C | C | C | C | |
| | 15pF (150) | C | C | C | C | C | C | C | C | C | C | |
| | 18pF (180) | C | C | C | C | C | C | C | C | C | C | |
| | 22pF (220) | C | C | C | C | C | C | C | C | C | C | |
| | 27pF (270) | C | C | C | C | C | C | C | C | C | C | |
| | 33pF (330) | C | C | C | C | C | C | C | C | C | C | |
| | 39pF (390) | C | C | C | C | C | C | C | C | C | C | |
| | 47pF (470) | C | C | C | C | C | C | C | C | C | C | |
| | 56pF (560) | C | C | C | C | C | C | C | C | C | C | |
| | 68pF (680) | C | C | C | C | C | C | C | C | C | C | |
| | 82pF (820) | C | C | C | C | C | C | C | C | C | C | |
| | 100pF (101) | C | C | C | C | C | C | C | C | C | D | |
| | 120pF (121) | C | C | C | C | C | C | C | C | C | D | |
| | 150pF (151) | C | C | C | C | C | C | C | C | C | D | |
| | 180pF (181) | C | C | C | C | C | C | C | C | C | D | |
| | 220pF (221) | C | C | C | C | C | C | C | C | C | G | |
| | 270pF (271) | C | C | C | C | C | C | C | C | C | G | |
| | 330pF (331) | C | C | C | C | C | C | C | C | C | G | |
| | 390pF (391) | C | C | C | C | C | C | C | C | C | G | |
| | 470pF (471) | C | C | C | C | C | C | C | C | C | G | |
| | 560pF (561) | C | C | C | C | C | C | C | C | C | G | |
| | 680pF (681) | C | C | C | C | C | C | C | C | C | G | |
| | 820pF (821) | C | C | C | C | C | C | C | C | C | G | |
| | 1,000pF (102) | C | C | C | C | C | D | D | D | D | G | |
| | 1,200pF (122) | C | C | C | C | C | D | D | D | D | K | |
| | 1,500pF (152) | C | C | C | C | C | D | D | D | D | K | |
| | 1,800pF (182) | C | C | C | C | C | D | D | D | D | K | |
| | 2,200pF (222) | C | C | C | C | C | D | D | D | D | K | |
| | 2,700pF (272) | C | C | C | C | C | D | D | D | D | K | |
| | 3,300pF (332) | C | C | C | C | C | D | D | D | D | K | |
| | 3,900pF (392) | C | C | C | C | C | D | D | D | D | K | |
| | 4,700pF (472) | C | C | C | C | C | G | G | G | G | K | |
| | 5,600pF (562) | C | C | C | C | C | G | G | G | G | K | |
| | 6,800pF (682) | C | C | C | C | C | G | G | G | G | K | |
| | 8,200pF (822) | C | C | C | C | C | G | G | G | G | K | |
| | 0.010μF (103) | C | C | C | C | C | G | G | K | K | M | M |
| | 0.012μF (123) | D | D | D | D | D | K | K | M | M | M | |
| | 0.015μF (153) | D | D | D | D | D | K | K | M | M | M | |
| | 0.018μF (183) | K | K | K | K | K | | | M | M | | |
| | 0.022μF (223) | K | K | K | K | K | | | M | M | | |
| | 0.027μF (273) | K | K | K | K | K | | | M | M | | |
| | 0.033μF (333) | K | K | K | K | K | | | M | M | | |
| | 0.039μF (393) | K | K | K | K | K | | | | | | |
| | 0.047μF (473) | K | K | K | K | K | | | | | | |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## X7R Dielectric

| DIELECTRIC | | X7R | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0201 | | | | 0402 | | | | | 0603 | | | | |
| RATED VOLTAGE | | 10 | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 100 | 10 | 16 | 25 | 50 | 100 |
| Capacitance | 100pF (101) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 120pF (121) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 150pF (151) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 180pF (181) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 220pF (221) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 270pF (271) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 330pF (331) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 390pF (391) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 470pF (471) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 560pF (561) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 680pF (681) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 820pF (821) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 1,000pF (102) | L | L | L | L | N | N | N | N | N | S | S | S | S | S |
| | 1,200pF (122) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 1,500pF (152) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 1,800pF (182) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 2,200pF (222) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 2,700pF (272) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 3,300pF (332) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 3,900pF (392) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 4,700pF (472) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 5,600pF (562) | L | L | L | | N | N | N | N | | S | S | S | S | S |
| | 6,800pF (682) | L | | | | N | N | N | N | | S | S | S | S | S |
| | 8,200pF (822) | L | | | | N | N | N | N | | S | S | S | S | S |
| | 0.010μF (103) | L | | | | N | N | N | N | | S | S | S | S | S |
| | 0.012μF (123) | | | | | N | N | N | | | S | S | S | S | X |
| | 0.015μF (153) | | | | | N | N | N | | | S | S | S | S | X |
| | 0.018μF (183) | | | | | N | N | N | N | | S | S | S | S | X |
| | 0.022μF (223) | | | | | N | N | N | N | | S | S | S | S | X |
| | 0.027μF (273) | | | | | N | N | N | N | | S | S | S | S | X |
| | 0.033μF (333) | | | | | N | N | N | N | | S | S | S | X | X |
| | 0.039μF (393) | | | | | N | N | N | N | | S | S | S | X | X |
| | 0.047μF (473) | | | | | N | N | N | N | | S | S | S | X | X |
| | 0.056μF (563) | | | | | N | N | N | N | | S | S | S | X | |
| | 0.068μF (683) | | | | | N | N | N | N | | S | S | S | X | |
| | 0.082μF (823) | | | | | N | N | N | N | | S | S | S | X | |
| | 0.10μF (104) | | | | | N | N | N | N | | S | S | S | X | |
| | 0.12μF (124) | | | | | | | | | | X | X | X | | |
| | 0.15μF (154) | | | | | | | | | | X | X | X | X | |
| | 0.18μF (184) | | | | | | | | | | X | X | X | | |
| | 0.22μF (224) | | | | | | | | | | X | X | X | X | |
| | 0.33μF (334) | | | | | | | | | | X | X | X | X | |
| | 0.47μF (474) | | | | | | | | | | | | | | |
| | 0.68μF (684) | | | | | | | | | | | | | | |
| | 0.82μF (824) | | | | | | | | | | | | | | |
| | 1.0μF (105) | | | | | | | | | | | X | | | |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

# X7R Dielectric

| DIELECTRIC | | X7R | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 0805 | | | | | | | | | 1206 | | | | | | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 630 |
| Capacitance | 100pF (101) | B | B | B | B | B | B | B | B | B | | | | | | D | D | D | D |
| | 120pF (121) | B | B | B | B | B | B | B | B | B | | | | | | D | D | D | D |
| | 150pF (151) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 180pF (181) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 220pF (221) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 270pF (271) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 330pF (331) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 390pF (391) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 470pF (471) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 560pF (561) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 680pF (681) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 820pF (821) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,000pF (102) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,200pF (122) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,500pF (152) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 1,800pF (182) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 2,200pF (222) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 2,700pF (272) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 3,300pF (332) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 3,900pF (392) | B | B | B | B | B | B | B | B | B | B | B | B | B | B | D | D | D | D |
| | 4,700pF (472) | B | B | B | B | B | B | B | D | D | B | B | B | B | B | D | D | D | D |
| | 5,600pF (562) | B | B | B | B | B | D | D | D | D | B | B | B | B | B | D | D | D | D |
| | 6,800pF (682) | B | B | B | B | B | D | D | D | D | B | B | B | B | B | D | D | D | D |
| | 8,200pF (822) | B | B | B | B | B | D | D | D | D | B | B | B | B | B | D | D | D | D |
| | 0.010μF (103) | B | B | B | B | B | D | D | D | D | B | B | B | B | B | D | D | D | D |
| | 0.012μF (123) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.015μF (153) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.018μF (183) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.022μF (223) | B | B | B | B | B | D | D | | | B | B | B | B | B | D | D | | |
| | 0.027μF (273) | B | B | B | B | D | | | | | B | B | B | B | B | | | | |
| | 0.033μF (333) | B | B | B | B | D | | | | | B | B | B | B | B | | | | |
| | 0.039μF (393) | B | B | B | B | D | | | | | B | B | B | B | B | | | | |
| | 0.047μF (473) | B | B | B | B | D | | | | | B | B | B | B | B | | | | |
| | 0.056μF (563) | B | B | B | B | D | | | | | B | B | B | B | B | | | | |
| | 0.068μF (683) | B | B | B | B | D | | | | | B | B | B | B | B | | | | |
| | 0.082μF (823) | B | B | B | B | D | | | | | B | B | B | B | D | | | | |
| | 0.10μF (104) | B | B | B | B | D | | | | | B | B | B | B | D | | | | |
| | 0.12μF (124) | B | B | B | D | | | | | | B | B | B | B | D | | | | |
| | 0.15μF (154) | D | D | D | D | | | | | | C | C | C | C | G | | | | |
| | 0.18μF (184) | D | D | D | D | | | | | | C | C | C | C | G | | | | |
| | 0.22μF (224) | D | D | D | D | | | | | | C | C | C | C | G | | | | |
| | 0.27μF (274) | D | D | D | I | | | | | | C | C | C | D | P | | | | |
| | 0.33μF (334) | D | D | D | I | | | | | | C | C | C | D | P | | | | |
| | 0.39μF (394) | D | D | D | I | | | | | | C | C | J | P | P | | | | |
| | 0.47μF (474) | D | D | D | I | | | | | | J | J | J | P | P | | | | |
| | 0.56μF (564) | D | D | D | | | | | | | J | J | J | P | P | | | | |
| | 0.68μF (684) | D | D | D | I | | | | | | J | J | J | P | P | | | | |
| | 0.82μF (824) | D | D | D | | | | | | | J | J | J | P | P | | | | |
| | 1.0μF (105) | D | D | D | I | | | | | | J | J | J | P | P | | | | |
| | 2.2μF (225) | | | | | | | | | | | | | P | P | | | | |
| | 4.7μF (475) | | | | | | | | | | | | | | | | | | |
| | 10μF (106) | | | | | | | | | | | | | | | | | | |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

# X7R Dielectric

| DIELECTRIC | | X7R | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SIZE | | 1210 | | | | | | | |
| RATED VOLTAGE (VDC) | | 10 | 16 | 25 | 50 | 100 | 250 | 500 | 1000 |
| Capacitance | 100pF (101) | | | | | | D | D | D |
| | 120pF (121) | | | | | | D | D | D |
| | 150pF (151) | | | | | | D | D | D |
| | 180pF (181) | | | | | | D | D | D |
| | 220pF (221) | | | | | | D | D | D |
| | 270pF (271) | | | | | | D | D | D |
| | 330pF (331) | | | | | | D | D | D |
| | 390pF (391) | | | | | | D | D | D |
| | 470pF (471) | | | | | | D | D | D |
| | 560pF (561) | | | | | | D | D | D |
| | 680pF (681) | | | | | | C | D | D |
| | 820pF (821) | | | | | | C | D | D |
| | 1,000pF (102) | C | C | C | C | C | C | D | D |
| | 1,200pF (122) | C | C | C | C | C | C | D | D |
| | 1,500pF (152) | C | C | C | C | C | C | D | D |
| | 1,800pF (182) | C | C | C | C | C | C | D | D |
| | 2,200pF (222) | C | C | C | C | C | C | D | D |
| | 2,700pF (272) | C | C | C | C | C | C | D | D |
| | 3,300pF (332) | C | C | C | C | C | C | D | D |
| | 3,900pF (392) | C | C | C | C | C | C | D | G |
| | 4,700pF (472) | C | C | C | C | C | C | D | G |
| | 5,600pF (562) | C | C | C | C | C | C | D | G |
| | 6,800pF (682) | C | C | C | C | C | C | D | G |
| | 8,200pF (822) | C | C | C | C | C | C | D | G |
| | 0.010μF (103) | C | C | C | C | C | C | D | G |
| | 0.012μF (123) | C | C | C | C | C | C | D | |
| | 0.015μF (153) | C | C | C | C | C | C | D | |
| | 0.018μF (183) | C | C | C | C | C | C | D | |
| | 0.022μF (223) | C | C | C | C | C | C | D | |
| | 0.027μF (273) | C | C | C | C | C | C | | |
| | 0.033μF (333) | C | C | C | C | C | C | | |
| | 0.039μF (393) | C | C | C | C | C | C | | |
| | 0.047μF (473) | C | C | C | C | C | D | | |
| | 0.056μF (563) | C | C | C | C | C | | | |
| | 0.068μF (683) | C | C | C | C | C | | | |
| | 0.082μF (823) | C | C | C | C | C | | | |
| | 0.10μF (104) | C | C | C | C | C | | | |
| | 0.12μF (124) | C | C | C | C | | | | |
| | 0.15μF (154) | C | C | C | C | | | | |
| | 0.18μF (184) | C | C | C | C | | | | |
| | 0.22μF (224) | C | C | C | C | | | | |
| | 0.27μF (274) | C | C | C | C | | | | |
| | 0.33μF (334) | C | C | C | D | | | | |
| | 0.39μF (394) | C | C | C | D | | | | |
| | 0.47μF (474) | C | C | C | D | | | | |
| | 0.56μF (564) | D | D | D | D | | | | |
| | 0.68μF (684) | D | D | D | D | | | | |
| | 0.82μF (824) | D | D | D | D | | | | |
| | 1.0μF (105) | D | D | D | D | | | | |
| | 1.5μF (155) | | K | | | | | | |
| | 2.2μF (225) | | K | | M | M | | | |
| | 4.7μF (475) | | | | M | M | | | |
| | 10μF (106) | | | M | M | | | | |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

## 8. PACKAGING STYLE AND QUANTITY

| Size | Thickness (mm)/Symbol | | Paper tape | | Plastic tape | |
|---|---|---|---|---|---|---|
| | | | 7" reel | 13" reel | 7" reel | 13" reel |
| 0201 (0603) | 0.30±0.03 | L | 15k | 70k | - | - |
| 0402 (1005) | 0.50±0.05 | N | 10k | 50k | - | - |
| 0603 (1608) | 0.80±0.07 | S | 4k | 15k | - | - |
| | 0.80+0.15/-0.10 | X | 4k | 15k | - | - |
| 0805 (2012) | 0.60±0.10 | A | 4k | 15k | - | - |
| | 0.80±0.10 | B | 4k | 15k | - | - |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.25±0.20 | I | - | - | 3k | 10k |
| 1206 (3216) | 0.80±0.10 | B | 4k | 15k | - | - |
| | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.15±0.15 | J | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | 10k |
| | 1.60+0.30/-0.10 | P | - | - | 2k | 9k |
| 1210 (3225) | 0.95±0.10 | C | - | - | 3k | 10k |
| | 1.25±0.10 | D | - | - | 3k | 10k |
| | 1.60±0.20 | G | - | - | 2k | 8k |
| | 2.00±0.20 | K | - | - | 1k | 6k |
| | 2.50±0.30 | M | - | - | 1k | 6k |

Unit: pieces

# 9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Pre-and Post-Stress Electrical Test</td><td>---</td><td></td></tr>
<tr><td>2.</td><td>High Temperature Exposure (Storage)<br>MIL-STD-202<br>Method 108</td><td>* Test temp.: 150±3°C<br>* Unpowered.<br>* Test time: 1000+24/-0 hrs.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change：X8G/NPO: within ±2.5% or ±0.25pF whichever is larger.<br>X7R: within ±10.00%.<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">≧ 100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF;0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF);0603≧0.47μF;<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="6">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td><td></td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>3.</td><td>Temperature Cycling<br>JESD22<br>Method JA-104</td><td>* Conduct 1000 cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp +0/-3</td><td>5±1</td></tr>
<tr><td>2</td><td>Max. operating temp +3/-0</td><td>5±1</td></tr>
</table>
* Before initial measurement (X7R only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>*Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change：X8G/NPO: within ±2.5% or 0.25pF whichever is larger.<br>X7R: within ±10.0%.<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">≧ 100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF;0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF);0603≧0.47μF;<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>10V</td><td>≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦15%</td><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>--</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>4.</td><td>Destructive Physical Analysis<br>EIA-469</td><td>Per EIA-469</td><td>No defects or abnormalities</td></tr>
<tr><td>5.</td><td>Moisture Resistance<br>MIL-STD-202<br>Method 106</td><td>* Test temp.: 25~65°C<br>* Humidity: 80~100% RH<br>* Test time: 10 cycles, t=24hrs/cycle.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change : X8G/NPO: within ±3.0% or 0.30pF whichever is larger<br>X7R: within ±12.5%.<br>* Q/D.F. value:<br>X8G/NPO: More than 30pF Q≥350 ; 10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF Q≥200+10C<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">≧ 100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF;0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF);0603≧0.47μF;<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td colspan="2"></td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>6.</td><td>Biased Humidity<br>MIL-STD-202<br>Method 103</td><td>* Test temp.: 85±3°C<br>* Humidity: 85%RH<br>* Test time: 1000+24/-0 hrs.<br>* To apply voltage：rated voltage and 1.3~1.5Vdc.<br>(add 100k ohm resistor)<br>* Before initial measurement (Class II only) : To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>
* No remarkable damage.<br>
* Cap change: X8G/NPO: within ±3.0% or 0.30pF whichever is larger.<br>X7R: within ±12.5%<br>
* Q/D.F. value:<br>X8G/NPO: C≥30pF , Q≥200 ; C<30pF , Q≥100+10/3C<br>
X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF;0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF);0603≧0.47μF;<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.<br>
Class II (X7R) for rated voltage test
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">500MΩ or RxC≥5 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
</table>
Class II (X7R) for 1.3~1.5Vdc
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≥10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
</table>
</td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200<br>Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>7.</td><td>Operational Life<br>MIL-STD-202<br>Method 108</td><td>* Test temp.:<br>Maximum Operating Temperature ±3°C<br>* To apply voltage:<br>(1) 10V≤Ur≤250V:200% of rated voltage.<br>(2) 150% of rated voltage:<br>a) 500V<br>b) ≤ 6.3V or C ≥10μF<br>c)
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr>
<tr><td>0402</td><td>X7R</td><td>50V</td><td>C>0.01μF</td></tr>
<tr><td rowspan="2">0603</td><td rowspan="2">X7R</td><td>≤25V</td><td>C≥1.0μF</td></tr>
<tr><td>50V</td><td>C>0.1μF</td></tr>
<tr><td rowspan="2">0805</td><td rowspan="2">X7R</td><td>50V</td><td>C≥0.68μF</td></tr>
<tr><td>≥100V</td><td>C≥0.12μF</td></tr>
<tr><td rowspan="2">1206</td><td rowspan="2">X7R</td><td>≤50V</td><td>C>1.0μF*</td></tr>
<tr><td>100V</td><td>C≥1.0μF</td></tr>
<tr><td rowspan="3">1210</td><td rowspan="3">X7R</td><td>≤50V</td><td>C>1.0μF</td></tr>
<tr><td>100V</td><td>C≥1.0μF</td></tr>
<tr><td>>100V</td><td>C≥0.22μF</td></tr>
<tr><td rowspan="2">1812</td><td rowspan="2">X7R</td><td>≤50V</td><td>C≥4.7μF</td></tr>
<tr><td>100V</td><td>C≥1.0μF</td></tr>
<tr><td>1825<br>2220<br>2225</td><td>X7R</td><td>≥100V</td><td>C≥1.0μF</td></tr>
<tr><td>ALL</td><td>X7R</td><td>ALL</td><td>C≥10μF</td></tr>
</table>
*Excluding ST31B105/50V=>"150% of rated voltage."<br>(3) 400V/450V/630V:120% of rated voltage.<br>(4) Ur≥1000V* : 110% of rated voltage.<br>Excluding NP0(1kV):1206/Cap≦102 & 1210/Cap≦153; X7R(1kV)1210/Cap≦103 =>"120% of rated voltage."<br>* Test time: 1000+24/-0 hrs.<br>* Before initial measurement (X7R only):<br>Apply test voltage for 1 hr at 125°C.<br>Remove and let set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change: X8G/NPO: within ±3.0% or ±0.3pF whichever is larger<br>X7R: within ±12.5%.<br>* Q/D.F. value:<br>X8G/NPO: More than 30pF, Q≥350 ; 10pF≤C<30pF, Q≥275+2.5C<br>Less than 10pF, Q≥200+10C<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">≧<br>100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF; 0402≧0.012μF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.047μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);<br>1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="5">25V</td><td rowspan="5">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF;0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF);0603≧0.47μF;<br>0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;<br>1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;<br>0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);<br>0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);<br>0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
</table></td></tr>
<tr><td>8.</td><td>External Visual<br>MIL-STD-883<br>Method 2009</td><td>Visual inspection</td><td>No remarkable defect.</td></tr>
<tr><td>9.</td><td>Physical Dimension<br>JESD22<br>Method JB-100</td><td>Using by calipers</td><td>Within the specified dimensions</td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>10.</td><td>Resistance to Solvents<br>MIL-STD-202<br>Method 215</td><td>* Temperature: 25±5°C<br>* Time: 3+0.5/-0 min.<br>* Solvent: Iso-propyl alcohol.</td><td>* No remarkable damage.<br>* Cap.: within the specified tolerance.<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td></td><td rowspan="10">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥2.2μF;0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF;0402≥2.2μF;0603≥10μF;0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF;0402≥1μF;0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF;0402≥1μF;0603≥10μF;0805≥47μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF;0805≥47μF;1206≥100μF</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200<br>Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>11.</td><td>Mechanical Shock<br>MIL-STD-202<br>Method 213</td><td>* Peak value: 1500g's.<br>* Wave: 1/2 sine.<br>* Velocity: 15.4 ft/sec<br>* Three shocks in each direction should be applied along<br>3 mutually perpendicular axes of the test specimen<br>(18 shocks)</td><td>* No remarkable damage.<br>* Cap.: within the specified tolerance.<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="3">6.3V</td><td rowspan="3">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td></td><td rowspan="9">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥2.2μF;0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF;0402≥2.2μF;0603≥10μF;0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF;0402≥1μF;0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF;0402≥1μF;0603≥10μF;0805≥47μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF;0805≥47μF;1206≥100μF</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>12.</td><td>Vibration<br>MIL-STD-202<br>Method 204</td><td>* Vibration frequency: 10~2000 Hz/min.<br>(5g's for 20 min)<br>* Total amplitude: 1.5mm<br>* 12 cycles each of 3 orientations (36 times)</td><td>* No remarkable damage.<br>* Cap.: within the specified tolerance.<br>* Q/D.F. value:<br>X8G/NPO:Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="3">6.3V</td><td rowspan="3">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td></td><td rowspan="9">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥2.2μF;0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF;0402≥2.2μF;0603≥10μF;0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF;0402≥1μF;0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF;0402≥1μF;0603≥10μF;0805≥47μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF;0805≥47μF;1206≥100μF</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>13.</td><td>Resistance to Soldering Heat<br>MIL-STD-202<br>Method 210</td><td>* Solder temperature: 260±5°C<br>* Dipping time: 10±1 sec<br>* Before initial measurement (X7R only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change: X8G/NPO: within ±2.5% or 0.25pF whichever is larger<br>X7R: within ±7.5%<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td></td><td rowspan="9">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥2.2μF;0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF;0402≥2.2μF;0603≥10μF;0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF;0402≥1μF;0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF;0402≥1μF;0603≥10μF;0805≥47μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF;0805≥47μF;1206≥100μF</td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>14</td><td>Thermal Shock<br>MIL-STD-202<br>Method 107</td><td>* Conduct 300 cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp +0/-3</td><td>15±3</td></tr>
<tr><td>2</td><td>Max. operating temp +3/-0</td><td>15±3</td></tr>
</table>
* Max. transfer time: 20 sec.<br>* Before initial measurement (X7R only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change：X8G/NPO: within ±2.5% or 0.25pF whichever is larger<br>X7R: within ±10.0%<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
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<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="6">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0201≥0.1uF;0402≥0.22μF;0603≥2.2μF;0805≥2.2μF;<br>1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;<br>1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td><td></td></tr>
</table></td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>15.</td><td>ESD<br>AEC-Q200-002</td><td>Per AEC-Q200-002</td><td>
* No remarkable damage.<br>
* Cap.: within the specified tolerance.<br>
* Q/D.F. value:<br>
X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>
X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="3">6.3V</td><td rowspan="3">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* I.R.: ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td></td><td rowspan="10">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥2.2μF;0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF;0402≥2.2μF;0603≥10μF;0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF;0402≥1μF;0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF;0402≥1μF;0603≥10μF;0805≥47μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF;0805≥47μF;1206≥100μF</td></tr>
</table>
</td></tr>
<tr><td>16.</td><td>Solderability<br>J-STD-002<br>JESD22-B102E</td><td>
* Condition A<br>
Un-mounted chips 4hrs / 155°C*dry then completely immersed for 5±0.5 sec in solder bath at 235±5°C.<br>
* Condition B<br>
Un-mounted chips steam 8 hrs then completely immersed for 10±1sec in solder bath at 215+5/-0°C.<br>
* Condition C<br>
Un-mounted chips steam 8 hrs then completely immersed for 10±1 sec. in solder bath at 260+0/-5°C.
</td><td>All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination.</td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>17.</td><td>Electrical Characterization</td><td>* Capacitance<br>* Q/ D.F. (Dissipation Factor)<br>*Test temp.: Room Temperature.<br>Class I: (X8G/NP0)<br>Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%<br>Cap>1000pF 1.0±0.2Vrms, 1KHz±10%<br>Class II: (X7R)<br>Cap ≤10μF, 1.0±0.2Vrms，1KHz±10%<br>Cap＞10μF, 0.5±0.2Vrms，120Hz±20%</td><td>* Capacitance within the specified tolerance.<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
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<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0402≧0.033μF; 0603≧0.15μF;<br>0805≧0.68μF; 1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
* Insulation Resistance<br>*Test temp.: Room Temperature.<br>100V:To apply rated voltage for max. 120 sec.<br>≥200V:To apply rated voltage (Max.500V) for 60 sec.<br>* Dielectric Strength<br>To apply voltage:<br>≦100 ≥2.5 times VDC<br>200V~300V ≥2 times VDC<br>400V~450V ≥1.2 times VDC<br>500V~999V ≥1.5 times VDC<br>1000V~3000V ≥1.2 times VDC<br>, duration 1~5 sec,<br>charge and discharge current less than 50mA.<br>* Temperature Coefficient (with no electrical load)<br>Operation temperature: Min. operating temp. to Max. operating temp. at 25°C</td><td>* IR. ≥10GΩ or RxC≥500Ω-F whichever is smaller.<br>Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V: 0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;<br>0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V: 0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;<br>1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V; 4V; Size≥1812</td></tr>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td></td><td rowspan="10">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥2.2μF;0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF;0402≥2.2μF;0603≥10μF;0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF;0402≥1μF;0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF;0402≥1μF;0603≥10μF;0805≥47μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF;0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF;0805≥47μF;1206≥100μF</td></tr>
</table>
* Dielectric strength<br>No evidence of damage or flash over during test.<br>* Temperature Coefficient<br>Capacitance Change: NPO: Within ±30ppm/°C<br>X7R: Within ±15%</td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

<table>
<tr><th>No.</th><th>AEC-Q200<br>Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>18.</td><td>Board Flex<br>AEC-Q200-005</td><td>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 3mm (2mm for X7R) and then the pressure shall be maintained for 60±1 sec.<br>* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.<br>* Cap change： X8G/NPO: within ±5% or 0.5pF whichever is larger<br>X7R: within ±12.5%<br>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>19.</td><td>Terminal Strength<br>AEC-Q200-006</td><td>* Pressurizing force：2N (0201 & 0402), 10N(0603), 18N(≥0805).<br>* Test time: 60±1 sec.</td><td>* No remarkable damage or removal of the terminations.<br>* Capacitance within the specified tolerance.<br>* Q/D.F. value:<br>X8G/NPO: Cap≥30pF, Q≥1000 ; Cap<30pF, Q≥400+20C.<br>X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF;2220≥4.7μF;2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 0402≥0.012μF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402>0.047μF; 0603>0.1μF; 0805/X7R>0.47μF;<br>1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;<br>0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
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<tr><td>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;<br>0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;<br>0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;<br>0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>20</td><td>Beam Load Test<br>AEC-Q200-003</td><td>* Break strength test<br>* Beam speed: 2.5±0.25 mm/sec</td><td>The chip endure following force<br>* Chip length ≤2.5mm: Thickness >0.5mm (20N), ≤0.5mm (8N)<br>* Chip length ≥3.2mm: Thickness ≥1.25mm (54.5N), <1.25mm (15N)</td></tr>
</table>

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

# APPENDIXES

## ◙ Tape & reel dimensions

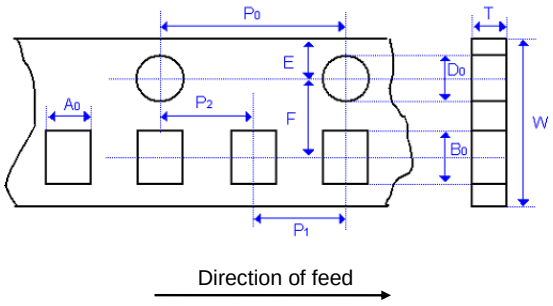



Fig. 2 The dimension of paper tape

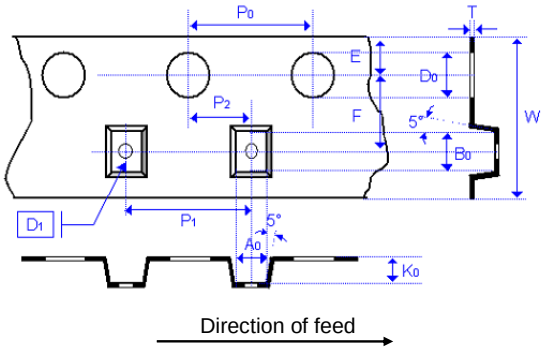



Fig. 3 The dimension of plastic tape

| Size | 0201 | 0402 | 0603 | 0805 | | | 1206 | | | 1210 | | | | 1808 | | 1812 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thickness | L | N,E | S,H,X | A,H | B,T | D,I | B,T | C,J,D | G,P | T | C,D | G,K | M | D,F | G,K | D,F | G,K | M,U |
| $A_0$ | 0.40 +/-0.10 | 0.70 +/-0.20 | 1.05 +/-0.30 | 1.50 +/-0.20 | 1.50 +/-0.20 | < 1.80 | 1.90 +/-0.50 | < 2.00 | <2.30 | < 3.05 | < 3.05 | < 3.05 | < 3.20 | < 2.50 | < 2.50 | < 3.90 | < 3.90 | < 3.90 |
| $B_0$ | 0.70 +/-0.10 | 1.20 +/-0.20 | 1.80 +/-0.30 | 2.30 +/-0.20 | 2.30 +/-0.20 | < 2.70 | 3.50 +/-0.50 | < 3.70 | < 4.00 | < 3.80 | < 3.80 | < 3.80 | <4.00 | < 5.30 | < 5.30 | < 5.30 | < 5.30 | < 5.30 |
| T | ≦0.55 | ≦0.80 | ≦1.20 | ≦1.15 | ≦1.20 | 0.23 +/-0.1 | ≦1.20 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.23 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 | 0.25 +/-0.1 |
| $K_0$ | 0.44 +/-0.05 | - | - | - | - | < 2.50 | - | < 2.50 | < 2.50 | < 1.50 | < 2.00 | < 2.50 | < 3.20 | < 2.50 | < 2.50 | < 2.50 | < 2.50 | < 3.50 |
| W | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 8.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 | 12.00 +/-0.30 |
| $P_0$ | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 |
| $10xP_0$ | 40.00 +/-0.10 | 40.00 +/-0.10 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 | 40.00 +/-0.20 |
| $P_1$ | 2.00 +/-0.05 | 2.00 +/-0.05 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 4.00 +/-0.10 | 8.00 +/-0.10 | 8.00 +/-0.10 | 8.00 +/-0.10 |
| $P_2$ | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.05 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 | 2.00 +/-0.10 |
| $D_0$ | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 | 1.50 +0.1/-0 |
| $D_1$ | - | - | - | - | - | 1.00 +/-0.10 | - | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.00 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 | 1.50 +/-0.10 |
| E | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 | 1.75 +/-0.10 |
| F | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 3.50 +/-0.05 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 | 5.50 +/-0.10 |

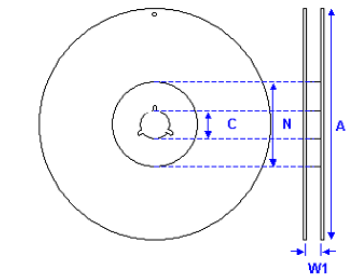
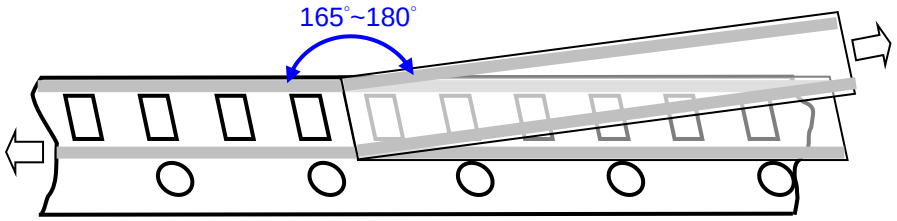



Fig. 4 The dimension of reel

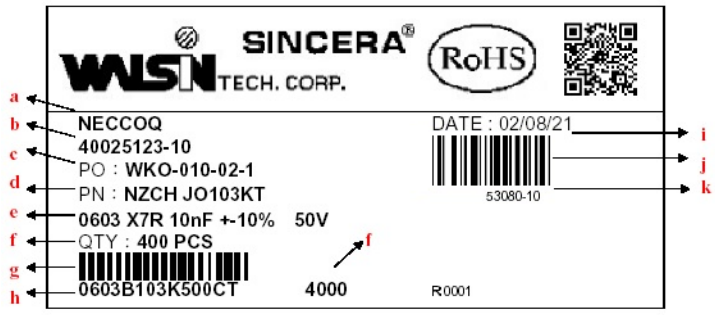
| Size | 0201, 0402, 0603, 0805, 1206, 1210 | | | 1812 |
|---|---|---|---|---|
| Reel size | 7" | 10" | 13" | 7" |
| C | 13.0±0.5 | 13.0±0.5 | 13.0±0.5 | 13.0±0.5 |
| $W_1$ | 10.0±1.5 | 10.0±1.5 | 10.0±1.5 | 12.4+2.0/-0 |
| A | 178.0±2.0 | 250.0±2.0 | 330.0±2.0 | 178.0±2.0 |
| N | 60.0+1.0/-0 | 50 min | 50 min | 60.0+1.0/-0 |

## ◙ Peeling force (EIA-481)

Peel-off force should be in the range of 10 grams to 100 grams at a peel-off speed of 300±10 mm/min.



## ◙ Example of customer label




*Customized label is available upon request

a. Customer name
b. WTC order series and item number
c. Customer P/O
d. Customer P/N
e. Description of product
f. Quantity
g. Bar code including quantity & WTC P/N or customer
h. WTC P/N
i. Shipping date
j. Order bar code including series and item numbers
k. Serial number of label

## ◙ Constructions

| No. | Name | | X8G, NP0 | X7R |
|---|---|---|---|---|
| ① | Ceramic material | | $CaZrO_3$ based | $BaTiO_3$ based |
| ② | Inner electrode | | Ni | |
| ③ | Termination | Inner layer | Cu | |
| ④ | | Middle layer | Ni | |
| ⑤ | | Outer layer | Sn (Matt) | |

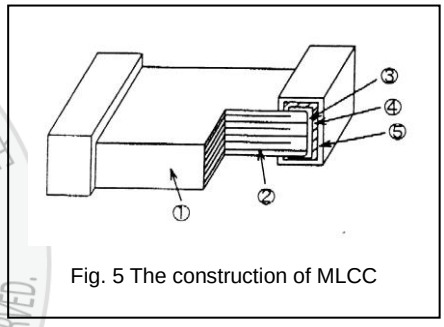



Fig. 5 The construction of MLCC

## ◙ Storage and handling conditions

(1) To store products at 5 to 40°C ambient temperature and 20 to 70%. related humidity conditions; MSL Level 1.
(2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight,the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

## Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of $N_2$ within oven are recommended.

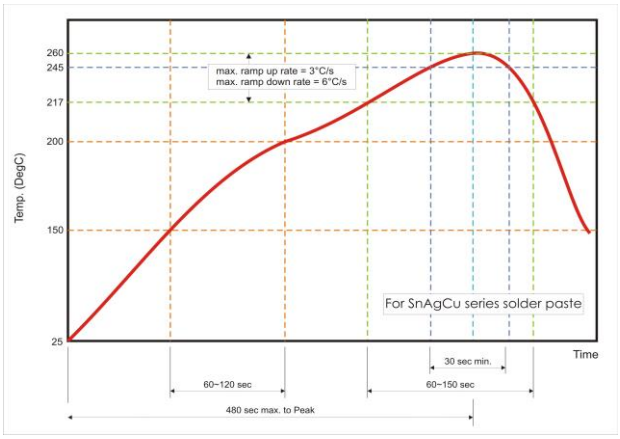



Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

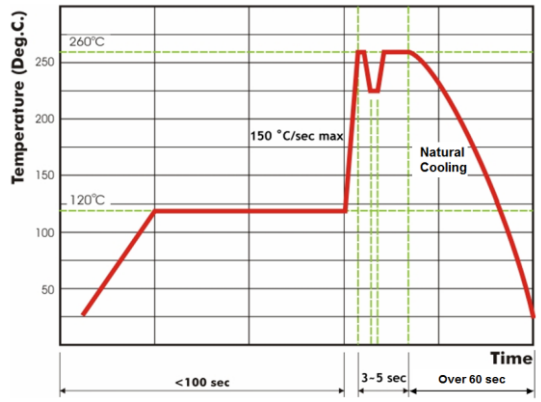



Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.