

TO. : _____




NO. : M180912



APPROVAL SHEET

MULTILAYER CERAMIC CAPACITOR
Commercial Grade
(Thin Layer Large-Capacitance Type)

Approved by customer : (signing or stamping here)

| SAMWHA CAPACITOR CO., LTD. | | |
|---|---|--|
| Written by | Checked by | Approved by |
|  |  |  |

2018. 09. 12.



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< SPEC SUMMARY >

| SAMWHA Part no. | | CS3216X5R106K500NRI | |
|-----------------------|-----------------|------------------------------|---|
| Type | | Thin Layer Large-Capacitance | |
| Item | Specification | Unit | Test methods and Conditions(Capacitance,IR) |
| Capacitance | 10 | μF | Testing Frequency : 1 \pm 0.1kHz Testing Voltage : 1 \pm 0.2Vrms |
| Capacitance Tolerance | ± 10 | % | |
| Dissipation Factor | Max. 12.5 | % | |
| Insulation Resistance | More than 5 | $\text{M}\Omega$ | Applied the rated voltage for 2 minutes of charging. |
| Chip Size | 3.20 \pm 0.30 | L (mm) | *Capacitance Tolerance Code --- page 1/8 *Chip size ----- page 2/8 *Characteristics & Test Method----- page 3/8~5/8 |
| | 1.60 \pm 0.20 | W (mm) | |
| | 1.60 \pm 0.20 | T (mm) | |

| | | | |
|------------------------------|--|------|--------------|
| Enactment : March 27,1996 | STANDARD | NO | SW - M - 04B |
| | MULTILAYER CERAMIC CAPACITOR Commercial Grade | Page | 1 / 8 |

1. General Article

Application Range

These specifications refer to the "Multilayer Ceramic Capacitors "mainly used to the computer equipment, communication equipment.

***Caution : Industrial equipment / For the high reliability equipment / LED equipment / Etc.
Please contact sales representatives or product engineers before using the products.
(For details, please refer Page 8)**

2. General Code

(1) Type Designation

CS 3216 X5R 106 K 500 N R I
 (1) (2) (3) (4) (5) (6) (7) (8) (9)

1) Multilayer Ceramic Capacitor (Commercial Grade)

2) Size Code :

This is expressed in tens of a millimeter.
The first two digits are the length, The last two digits are width.

3) Temperature Coefficient Code

| Classification | Code | Temperature Range | Capacitance Tolerance |
|----------------|------|-------------------|-----------------------|
| Class I | C0G | -55 to +125℃ | ±30 ppm/℃ |
| Class II | X5R | -55 to +85℃ | ±15% |
| | X7R | -55 to +125℃ | ±15% |
| | X7S | -55 to +125℃ | ±22% |
| | X7T | -55 to +125℃ | +22% ~ -33% |
| | Y5V | -30 to +85℃ | +22% ~ -82% |

4) Capacitance Code(Pico farads) :

The nominal Capacitance Value in pF is expressed by three digit numbers.

The first two digits represents significant figures and the last digit denotes the number of zero

ex) 104 = 100000 pF

R denotes decimal

8R2 = 8.2 pF

5) Capacitance Tolerance Code

| Code | Tolerance |
|------|-----------|
| B | ± 0.1 pF |
| C | ± 0.25 pF |
| D | ± 0.5 pF |
| F | ± 1.0 % |
| G | ± 2.0 % |
| J | ± 5 % |
| K | ± 10 % |

| Code | Tolerance |
|------|--------------|
| M | ± 20 % |
| P | + 100, - 0% |
| Z | + 80, - 20% |
| H | + 0.25/-0 pF |
| I | + 0/-0.25 pF |
| U | + 5/-0 % |
| V | + 0/-5 % |

6) Voltage Code

| | | | | | | | | | | | | | | |
|------|------------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|-----------|-----------|-----------|
| code | 6R3 | 100 | 160 | 250 | 350 | 500 | 101 | 201 | 251 | 501 | 631 | 102 | 202 | 302 |
| Vol. | DC 6.3V | DC 10V | DC 16V | DC 25V | DC 35V | DC 50V | DC 100V | DC 200V | DC 250V | DC 500V | DC 630V | DC 1KV | DC 2KV | DC 3KV |

7) Termination Code

ex) N : Ni-Sn (Nickel-Tin Plate)

A : Ag/Ni-Sn (Ag Epoxy/Nickel-Tin Plate) -> **Soft Termination Type**

8) Packing Code

ex) R : 7" Reel Type

L : 13" Reel Type

B : Bulk Type

9) Thickness option

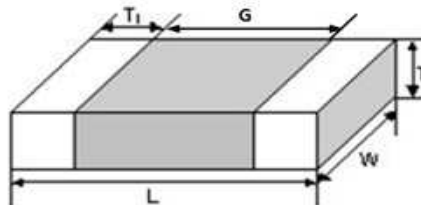
| Thickness(mm) | | Code | Thickness(mm) | | Code |
|---------------|--------|-------|---------------|--------|------|
| t | Tol(±) | | t | Tol(±) | |
| 0.30 | 0.03 | Blank | 1.30 | 0.20 | E |
| 0.50 | 0.05 | Blank | 1.35 | 0.20 | H |
| 0.60 | 0.10 | A | 1.60 | 0.20 | I |
| 0.80 | 0.10 | B | 1.80 | 0.20 | J |
| 0.85 | 0.15 | B | 2.00 | 0.25 | K |
| 1.00 | 0.15 | E | 2.50 | 0.25 | L |
| 1.10 | 0.15 | E | 2.80 | 0.30 | M |
| 1.15 | 0.15 | E | 3.20 | 0.30 | N |
| 1.25 | 0.15 | E | 5.00 | 0.40 | O |

3. Temperature Characteristics

See Page 5/8 (No.13)

4. Constructions and Dimensions

(1) Dimensions



(Unit : mm)

| Code | Dimension | | | | | |
|------|-----------|--------|-------|--------|---------|--------|
| | Length | | Width | | T1(min) | G(min) |
| | L | Tol(±) | W | Tol(±) | | |
| 0603 | 0.60 | 0.03 | 0.30 | 0.03 | 0.05 | 0.15 |
| 1005 | 1.00 | 0.05 | 0.50 | 0.05 | 0.05 | 0.30 |
| 1608 | 1.60 | 0.15 | 0.80 | 0.10 | 0.10 | 0.50 |
| 2012 | 2.00 | 0.20 | 1.25 | 0.15 | 0.10 | 0.65 |
| 3216 | 3.20 | 0.30 | 1.60 | 0.20 | 0.15 | 1.00 |
| 3225 | 3.20 | 0.40 | 2.50 | 0.25 | 0.15 | 1.05 |
| 4520 | 4.50 | 0.40 | 2.00 | 0.25 | 0.20 | 1.50 |
| 4532 | 4.50 | 0.40 | 3.20 | 0.30 | 0.20 | 1.50 |
| 5750 | 5.70 | 0.50 | 5.00 | 0.40 | 0.30 | 1.85 |

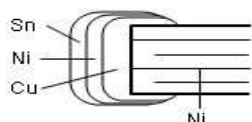
*1005 Size $\geq 4.7\mu F \Rightarrow L, W, T : Tol \pm 0.15$

*1608 Size $\geq 10\mu F \Rightarrow W : 0.80 \pm 0.15, T : 0.80 \pm 0.15$

*2012 Size $\geq 10\mu F \Rightarrow W : 1.25 \pm 0.20, T : 0.85 \pm 0.15$

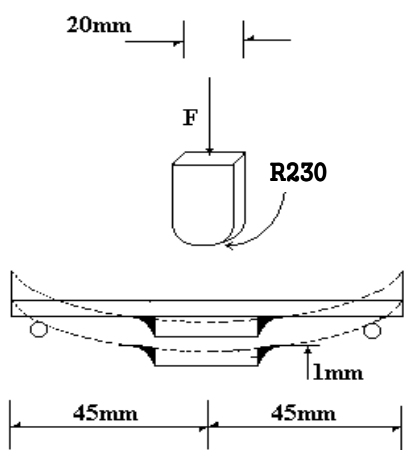
*3216 Size $\geq 47\mu F \Rightarrow W : 1.60 \pm 0.30, T : 1.60 \pm 0.30$

(2) Construction of Termination



Specifications and Test Methods (Thin Layer Large-Capacitance Type)

| No. | Item | Specification | Test Methods and Conditions | | | | | | | | | | | | | | | |
|---|------------------------------|--|---|-------------|-----------|---------|----------|------------|-------------|----------------------------|------------|----------------------------|-----------|------------|------|-------|------|-------|
| 1 | Operating Temperature Range | X7R, X7S, X7T : -55 to +125°C X5R : -55 to +85°C Y5V : -30 to +85°C | | | | | | | | | | | | | | | | |
| 2 | Insulation Resistance | 50Ω·F min | ·Applied the rated voltage for 2 minutes of charging. The charge/discharge current is less than 50mA. | | | | | | | | | | | | | | | |
| 3 | Dielectric Strength | No defects or abnormalities | X7R, X7S, X7T, X5R, Y5V : The rated voltage × 250% - Applied between the terminations for 1 to 5 seconds. - The charge/discharge current is less than 50mA. | | | | | | | | | | | | | | | |
| 4 | Capacitance | within the specified tolerance | The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | |
| 5 | Dissipation Factor | X7R, X7S, X7T, X5R : 12.5%max *3216 Size 100μF : 15%max Y5V : 20%max | <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>C ≤ 10μF</td> <td>1 ± 0.1kHz</td> <td>0.5~1.0Vrms</td> </tr> <tr> <td>C > 10μF</td> <td>120 ± 24Hz</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table> | Capacitance | Frequency | Voltage | C ≤ 10μF | 1 ± 0.1kHz | 0.5~1.0Vrms | C > 10μF | 120 ± 24Hz | 0.5±0.1Vrms | | | | | | |
| | | | Capacitance | Frequency | Voltage | | | | | | | | | | | | | |
| C ≤ 10μF | 1 ± 0.1kHz | 0.5~1.0Vrms | | | | | | | | | | | | | | | | |
| C > 10μF | 120 ± 24Hz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | |
| <ul style="list-style-type: none"> Initial measurement Perform the initial measurement according to Note1 for Class II Measurement after test Take it out and set it for 24±2 hours (Class II) then measure | | | | | | | | | | | | | | | | | | |
| 6 | Solderability of Termination | -Termination should be covered with more than 75% of new solder | *Pb-Free type Solder : 96.5Sn-3Ag-0.5Cu Solder temperature : 245±5°C Immersion time : 3±0.1sec *Pre-Heating : at 80~120°C for 10~30sec | | | | | | | | | | | | | | | |
| 7 | Resistance to Soldering Heat | Appearance | No defects which may affect performance | | | | | | | | | | | | | | | |
| | | Capacitance change | X7R, X7S, X7T, X5R : Within±7.5% Y5V : Within±20% | | | | | | | | | | | | | | | |
| | | Dissipation Factor | X7R, X7S, X7T, X5R : 12.5%max *3216 Size 100μF : 15%max Y5V : 20%max | | | | | | | | | | | | | | | |
| | | I.R. | 50Ω·F min | | | | | | | | | | | | | | | |
| | | | Preheat the capacitor at 120 to 150°C for 1 minute. (Preheating for 3225,4520,4532 Step1:100°C to 120°C, 1min Step2:170°C to 200°C, 1min) Immerse the capacitor in a eutectic solder solution at 260±5°C for 10±0.5 seconds. | | | | | | | | | | | | | | | |
| | | | ·Initial measurement Perform the initial measurement according to Note1 for Class II ·Measurement after test Let sit at room temperature for 24±2 hours,then measure. | | | | | | | | | | | | | | | |
| 8 | Temperature Cycle | Appearance | No defects which may affect performance | | | | | | | | | | | | | | | |
| | | Capacitance Change | X7R, X7S, X7T, X5R : Within ±7.5% Y5V : Within ±20% | | | | | | | | | | | | | | | |
| | | Dissipation Factor | X7R, X7S, X7T, X5R : 12.5%max *3216 Size 100μF : 15%max Y5V : 20%max | | | | | | | | | | | | | | | |
| | | I.R. | 50Ω·F min | | | | | | | | | | | | | | | |
| | | | Perform the five cycles according to the four heat treatments listed in the following table. | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp (°C)</td> <td>Min. operating temp. +0/-3</td> <td>Room Temp</td> <td>Max. operating temp. +3/-0</td> <td>Room Temp</td> </tr> <tr> <td>Time (min)</td> <td>30±3</td> <td>2 to3</td> <td>30±3</td> <td>2 to3</td> </tr> </tbody> </table> | Step | 1 | 2 | 3 | 4 | Temp (°C) | Min. operating temp. +0/-3 | Room Temp | Max. operating temp. +3/-0 | Room Temp | Time (min) | 30±3 | 2 to3 | 30±3 | 2 to3 |
| Step | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | |
| Temp (°C) | Min. operating temp. +0/-3 | Room Temp | Max. operating temp. +3/-0 | Room Temp | | | | | | | | | | | | | | |
| Time (min) | 30±3 | 2 to3 | 30±3 | 2 to3 | | | | | | | | | | | | | | |
| | | | ·Initial measurement Perform the initial measurement according to Note1 for Class II ·Measurement after test Perform the final measurement according to Note2 | | | | | | | | | | | | | | | |

| No. | Item | Specification | Test Methods and Conditions | | | | | | | | |
|--------------------|--|---|-----------------------------|--|---|---|--------------------|--|---|----------------------|--|
| 9 | High Temperature Load | <table border="1"> <tr> <td data-bbox="295 215 454 324">Appearance</td> <td data-bbox="454 215 949 324">No defects which may affect performance</td> </tr> <tr> <td data-bbox="295 324 454 414">Capacitance Change</td> <td data-bbox="454 324 949 414">X7R, X7S, X7T, X5R : Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$</td> </tr> <tr> <td data-bbox="295 414 454 526">Dissipation Factor</td> <td data-bbox="454 414 949 526">X7R, X7S, X7T, X5R : 20%max *3216 Size 100μF : 30%max Y5V : 40%max</td> </tr> <tr> <td data-bbox="295 526 454 683">I.R</td> <td data-bbox="454 526 949 683">12.5Ω·F min</td> </tr> </table> | Appearance | No defects which may affect performance | Capacitance Change | X7R, X7S, X7T, X5R : Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ | Dissipation Factor | X7R, X7S, X7T, X5R : 20%max *3216 Size 100 μ F : 30%max Y5V : 40%max | I.R | 12.5 Ω ·F min | <p>Apply 100% of the rated voltage for 1000+48/-0 hrs at the maximum operating temperature $\pm 3^{\circ}\text{C}$. The charge/discharge current is less than 50mA.</p> <p>-Initial measurement Perform the initial measurement according to Note1 for Class II</p> <p>-Measurement after test Perform the final measurement according to Note2</p> |
| Appearance | No defects which may affect performance | | | | | | | | | | |
| Capacitance Change | X7R, X7S, X7T, X5R : Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ | | | | | | | | | | |
| Dissipation Factor | X7R, X7S, X7T, X5R : 20%max *3216 Size 100 μ F : 30%max Y5V : 40%max | | | | | | | | | | |
| I.R | 12.5 Ω ·F min | | | | | | | | | | |
| 10 | Bending strength |  <p>No cracking or marking defects shall occur</p> <table border="1"> <tr> <td data-bbox="295 1220 454 1294">Capacitance Change</td> <td data-bbox="454 1220 949 1294">X7R, X7S, X7T, X5R: Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ Within +30/-40% (cap$\geq 10\mu$F)</td> </tr> </table> | Capacitance Change | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ Within +30/-40% (cap $\geq 10\mu$ F) | <p>·Substrate material : Glass EPOXY Board.</p> <p>·Thickness : 1.6mm 0.8mm(0603/1005size)</p> <p>*. Test condition - Bending limit : 1mm - Pressurizing speed : 1mm/sec - Holding time : 5\pm1sec</p> | | | | | | |
| Capacitance Change | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ Within +30/-40% (cap $\geq 10\mu$ F) | | | | | | | | | | |
| 11 | Vibration Resistance | <table border="1"> <tr> <td data-bbox="295 1294 454 1355">Appearance</td> <td data-bbox="454 1294 949 1355">No defects or abnormalities</td> </tr> <tr> <td data-bbox="295 1355 454 1422">Capacitance</td> <td data-bbox="454 1355 949 1422">Whin the specified tolerance</td> </tr> <tr> <td data-bbox="295 1422 454 1675">Dissipation Factor</td> <td data-bbox="454 1422 949 1675">X7R, X7S, X7T, X5R : 12.5%max *3216 Size 100μF : 15%max Y5V : 20%max</td> </tr> </table> | Appearance | No defects or abnormalities | Capacitance | Whin the specified tolerance | Dissipation Factor | X7R, X7S, X7T, X5R : 12.5%max *3216 Size 100 μ F : 15%max Y5V : 20%max | <p>*Shown in Fig. After soldering and then let sit for 24\pm2hr at room temperature. The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz, shall be traversed(from 10Hz to 55Hz then 10Hz again) in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions(total is 6hours).</p> | | |
| Appearance | No defects or abnormalities | | | | | | | | | | |
| Capacitance | Whin the specified tolerance | | | | | | | | | | |
| Dissipation Factor | X7R, X7S, X7T, X5R : 12.5%max *3216 Size 100 μ F : 15%max Y5V : 20%max | | | | | | | | | | |
| 12 | Humidity Load | <table border="1"> <tr> <td data-bbox="295 1675 454 1765">Appearance</td> <td data-bbox="454 1675 949 1765">No defects which may affect performance</td> </tr> <tr> <td data-bbox="295 1765 454 1854">Capacitance Change</td> <td data-bbox="454 1765 949 1854">X7R, X7S, X7T, X5R: Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$</td> </tr> <tr> <td data-bbox="295 1854 454 1960">Dissipation Factor</td> <td data-bbox="454 1854 949 1960">X7R, X7S, X7T, X5R : 20%max *3216 Size 100μF : 30%max Y5V : 40%max</td> </tr> <tr> <td data-bbox="295 1960 454 2072">I.R.</td> <td data-bbox="454 1960 949 2072">12.5Ω·F min</td> </tr> </table> | Appearance | No defects which may affect performance | Capacitance Change | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ | Dissipation Factor | X7R, X7S, X7T, X5R : 20%max *3216 Size 100 μ F : 30%max Y5V : 40%max | I.R. | 12.5 Ω ·F min | <p>Apply the rated voltage at 40\pm2$^{\circ}\text{C}$ and 90 to 95%RH for 500+24/-0 hrs. The charge/discharge current is less than 50mA.</p> <p>·Initial measurement Perform the initial measurement according to Note1 for Class II</p> <p>·Measurement after test Perform the final measurement according to Note2</p> |
| Appearance | No defects which may affect performance | | | | | | | | | | |
| Capacitance Change | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$ Y5V : Within $\pm 30\%$ | | | | | | | | | | |
| Dissipation Factor | X7R, X7S, X7T, X5R : 20%max *3216 Size 100 μ F : 30%max Y5V : 40%max | | | | | | | | | | |
| I.R. | 12.5 Ω ·F min | | | | | | | | | | |

| No. | Item | Specification | | | | Test Methods and Conditions |
|-----|---|---------------|-----------------|--------------------|-----------------|---|
| 13 | Capacitance Temperature Characteristics | Char. | Temp. Range | Reference Temp. | Cap. Change | <p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <p>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</p> |
| | | X5R | -55 to +85°C | 25°C | Within ±15% | |
| | | X7R | -55 to +125°C | 25°C | Within ±15% | |
| | | X7S | -55 to +125°C | 25°C | Within ±22% | |
| | | X7T | -55 to +125°C | 25°C | Within +22/-33% | |
| Y5V | -30 to +85°C | 25°C | Within +22/-82% | | | |

*Note1. Initial Measurement for Class II

Perform a heat treatment at 150+0,-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure

*Note2. Measurement after test

Class II

Perform a heat treatment at 150+0,-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.

5. Packing

(1) Bulk packing

- ① 1000 pcs per Polybag
- ② 5 Polybags per Inner box
- ③ 10 Inner boxes per Out box

(2) Reel Packing

- ① 8~10 Reels per Inner box
- ② 6 Inner boxes per Out box

(3) Reel Dimensions



(Unit : mm)

| MARK | SIZE | A | B | C | D | E | W |
|-----------|-----------|-------------------|----------------------|-------------------|-------------------|-------------|--------------|
| 7 " REEL | 0603~3225 | $\Phi 178 \pm 2$ | $\Phi 50 \text{Min}$ | $\Phi 13 \pm 0.5$ | $\Phi 21 \pm 0.8$ | 2 ± 0.5 | 10 ± 1.5 |
| | 4520~4532 | $\Phi 180 +0, -3$ | $\Phi 60 -0, +1$ | $\Phi 13 \pm 0.2$ | $\Phi 57 -0 +1$ | 3 ± 0.2 | 13 ± 0.5 |
| 13 " REEL | 1005~3225 | $\Phi 330 \pm 2$ | $\Phi 70 \text{Min}$ | $\Phi 13 \pm 0.5$ | $\Phi 21 \pm 0.8$ | 2 ± 0.5 | 10 ± 1.5 |

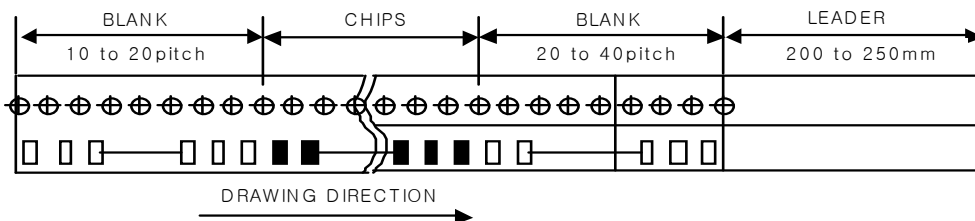
(4) Number of Package

| TYPE | EIA CODE | 7" | 13" |
|--------|----------|---------------|----------------|
| | | Qt/REEL | Qt/REEL |
| CS0603 | CC0201 | 15,000 | |
| CS1005 | CC0402 | 10,000 | 50,000 |
| CS1608 | CC0603 | 4,000 | 16,000 |
| CS2012 | CC0805 | 3,000 ~ 4,000 | 10,000 |
| CS3216 | CC1206 | 2,000 ~ 4,000 | 6,000 ~ 10,000 |
| CS3225 | CC1210 | 1,000 ~ 3,000 | 4,000 ~ 10,000 |
| CS4520 | CC1808 | 1,500 ~ 3,000 | - |
| CS4532 | CC1812 | 500 ~ 1,000 | 1,500 ~ 5,000 |

(5) Tape Dimensions



| TYPE | EIA CODE | A | B | C | D | E | F | G | H | J |
|--------|----------|-----------------|-----------------|----------------|----------------|----------------|--------------------------------|---------------|---------------|---------------|
| CS0603 | CC0201 | 0.67 ± 0.05 | 0.37 ± 0.05 | 8.0 ± 0.3 | 3.5 ± 0.05 | 1.75 ± 0.1 | 2.0 ± 0.05 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS1005 | CC0402 | 1.15 ± 0.1 | 0.65 ± 0.1 | 8.0 ± 0.3 | 3.5 ± 0.05 | 1.75 ± 0.1 | 2.0 ± 0.05 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS1608 | CC0603 | 1.9 ± 0.2 | 1.10 ± 0.2 | 8.0 ± 0.3 | 3.5 ± 0.05 | 1.75 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS2012 | CC0805 | 2.4 ± 0.2 | 1.65 ± 0.2 | 8.0 ± 0.3 | 3.5 ± 0.05 | 1.75 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS3216 | CC1206 | 3.6 ± 0.2 | 2.00 ± 0.2 | 8.0 ± 0.3 | 3.5 ± 0.05 | 1.75 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS3225 | CC1210 | 3.6 ± 0.2 | 2.80 ± 0.2 | 8.0 ± 0.3 | 3.5 ± 0.05 | 1.75 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS4520 | CC1808 | 4.8 ± 0.2 | 2.3 ± 0.2 | 12.0 ± 0.3 | 5.5 ± 0.1 | 1.75 ± 0.1 | 4.0 ± 0.1 8.0 ± 0.1 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |
| CS4532 | CC1812 | 4.9 ± 0.2 | 3.6 ± 0.2 | 12.0 ± 0.3 | 5.5 ± 0.1 | 1.75 ± 0.1 | 8.0 ± 0.1 | 2.0 ± 0.1 | 4.0 ± 0.1 | 1.5 ± 0.1 |



6. Caution

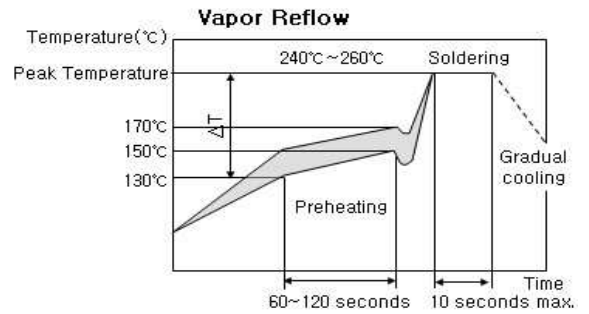
▶ Reflow Soldering

1. The sudden temperature change easily causes mechanical damages to ceramic components. Therefore, the preheating procedures should be required for the soldering of ceramic components.
2. Please refer to the recommended soldering profiles as shown in figures, and keep the temperature difference(ΔT) within the range recommended in Table 1.

Table 1

| Size code | Temperature Difference |
|------------------------------|-----------------------------------|
| 0603, 1005, 1608, 2012, 3216 | $\Delta T \leq 190^\circ\text{C}$ |
| 3225size and over | $\Delta T \leq 130^\circ\text{C}$ |

[Standard Conditions for Reflow Soldering]



[Allowable Soldering Temperature and Time]



In case of repeated soldering, the accumulated soldering time must be within the range shown above.

▶ Storage Condition

*When Solderability is considered, Capacitor are recommended to be used in 12 months

- (1) Temperature: $25^\circ\text{C} \pm 10^\circ\text{C}$
- (2) Relative Humidity: Below 70% RH

▶ The Regulation of Environmental Pollution Materials.

*Never use materials mentioned below in MLCC products regulated this document.

Pb, Cd, Hg, Cr^{+6} , PBB(Polybromide biphenyl), PBDE(Polybrominated diphenyl ethers), asbestos.

* Note

(1) 'Aging'/'De-aging' Behavior of high dielectric MLCCs

(Typically represented by X7R, Y5V temperature characteristic of which main composition is BaTiO₃)

'Aging' / 'De-aging' Behavior of high dielectric MLCCs Please note that high dielectric type dielectric Ceramic Capacitors have a "normal" 'aging' behavior / characteristic, that is; their capacitance value decreases with time from its value when it was first manufactured. From that date, the capacitance value begins to decrease at a logarithmic rate defined by:

$$C_t = C_{24} (1 - k \log_{10} t)$$

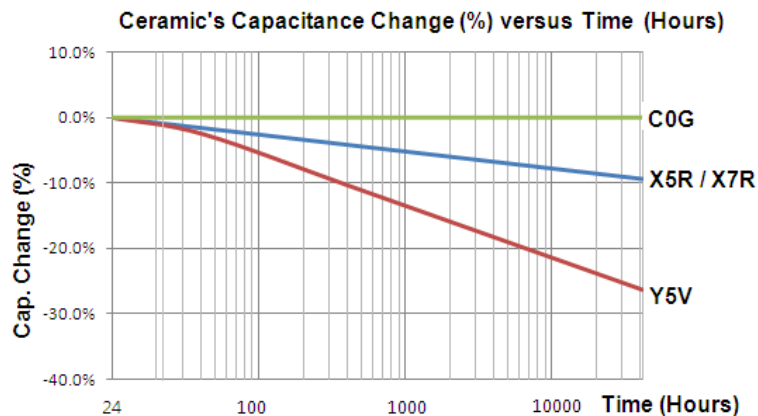
where :

C_t = Capacitance Value, t hours after the start of 'aging'

C_{24} = Capacitance Value, 24 hours after its manufacture

k = aging constant (capacitance decrease per decade-hour)

t = time, in hours, from the start of 'aging'



The capacitance value can be restored (a.k.a. 'de-aged') by exposing the component to elevated temperatures approaching its Curie Temperature (approximately 120°C). This 'deaging' can occur during the component's solder-assembly onto the PCB, during life or temperature cycle testing., or by ' baking ' at 150°C for about 1 hour.

(2) Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- ① Aircraft equipment ② Aerospace equipment ③ Undersea equipment ④ Power plant equipment
- ⑤ Medical equipment ⑥ Transportation equipment (vehicles, trains, ships, etc.)
- ⑦ Traffic signal equipment ⑧ Disaster prevention / crime prevention equipment
- ⑨ Industrial equipment (Conveyors, Robot equipment, etc) ⑩ Led equipment
- ⑪ Application of similar complexity and/or reliability requirements to the applications listed above