

TO. : \_\_\_\_\_




NO. : \_\_\_\_\_



# 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  |
|  |  |  |

2020. 03. 13.



**SAMWHA CAPACITOR CO., LTD.**

Address : 124, BUK-RI, NAMSA-MYUN YOUNGIN-SI, KYUNGKI-DO, KOREA

Contact : TEL 82-31-332-6441 , FAX 82-31-332-7661

Home page : [www.samwha.com](http://www.samwha.com)

## < SPEC SUMMARY >

| SAMWHA Part no.       |                 | CS3216X7R106K250NRI          |   |
|-----------------------|-----------------|------------------------------|---|
| Type                  |                 | Thin Layer Large-Capacitance |   |
| Item                  | Specification   | Unit                         | Test methods and Conditions(Capacitance,IR)   |
| Capacitance           | 10              | $\mu\text{F}$                | Testing Frequency : 1 $\pm$ 0.1kHz<br>Testing Voltage : 1 $\pm$ 0.2Vrms   |
| Capacitance Tolerance | $\pm 10$        | %                            |   |
| 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<br>*Chip size ----- page 2/8<br>*Characteristics & Test Method----- page 3/8~5/8 |
|                       | 1.60 $\pm$ 0.20 | W (mm)                       |   |
|                       | 1.60 $\pm$ 0.20 | T (mm)                       |   |

|                              |  |      |              |
|------------------------------|--|------|--------------|
| Enactment :<br>March 27,1996 | <b>STANDARD</b>                                  | NO   | SW - M - 04B |
|                              | MULTILAYER CERAMIC CAPACITOR<br>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    X7R    106    K    250    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<br>6.3V | DC<br>10V | DC<br>16V | DC<br>25V | DC<br>35V | DC<br>50V | DC<br>100V | DC<br>200V | DC<br>250V | DC<br>500V | DC<br>630V | DC<br>1KV | DC<br>2KV | DC<br>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

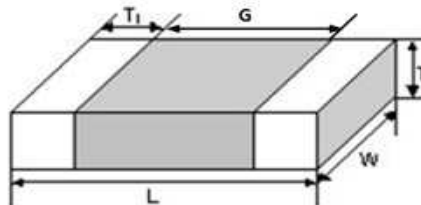
| Thickness(mm) |        | Code  | Thickness(mm) |        | Code |
|---------------|--------|-------|---------------|--------|------|
| t             | Tol(±) |       | t             | Tol(±) |      |
| 0.30          | 0.03   | Blank | 1.30          | 0.20   | E    |
| 0.50          | 0.05   | Blank | 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  $\geq 10\mu F \Rightarrow W : 1.25 \pm 0.20, T : 0.85 \pm 0.15$

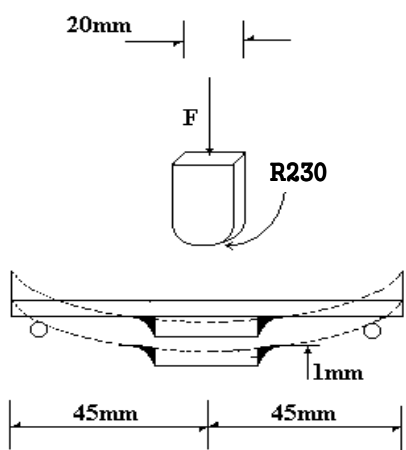
\*3216 Size  $\geq 47\mu F \Rightarrow W : 1.60 \pm 0.30, T : 1.60 \pm 0.30$

(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<br>X5R : -55 to +85°C<br>Y5V : -30 to +85°C  |   |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
| 2   | Insulation Resistance        | 50Ω·F min  | ·Applied the rated voltage for 2 minutes of charging.<br>The charge/discharge current is less than 50mA.  |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
| 3   | Dielectric Strength          | No defects or abnormalities  | X7R, X7S, X7T, X5R, Y5V : The rated voltage × 250%<br>- Applied between the terminations for 1 to 5 seconds.<br>- 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<br>*3216 Size 100μF : 15%max<br>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 &gt; 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"> <li>Initial measurement</li> <li>Perform the initial measurement according to Note1 for Class II</li> <li>Measurement after test</li> <li>Take it out and set it for 24±2 hours (Class II) then measure</li> </ul> |                              |  |   |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
| 6   | Solderability of Termination | -Termination should be covered with more than 75% of new solder            | *Pb-Free type<br>Solder : 96.5Sn-3Ag-0.5Cu<br>Solder temperature : 245±5°C<br>Immersion time : 3±0.1sec<br>*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%<br>Y5V : Within±20%  |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
|   |                              | Dissipation Factor   | X7R, X7S, X7T, X5R : 12.5%max<br>*3216 Size 100μF : 15%max<br>Y5V : 20%max  |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
|   |                              | I.R.   | 50Ω·F min   |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
|   |                              |  | Preheat the capacitor at 120 to 150°C for 1 minute.<br>(Preheating for 3225,4520,4532<br>Step1:100°C to 120°C, 1min<br>Step2:170°C to 200°C, 1min )<br>Immerse the capacitor in a eutectic solder solution at 260±5°C for 10±0.5 seconds.   |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
| 8   | Temperature Cycle            | Appearance   | No defects which may affect performance   |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
|   |                              | Capacitance Change   | X7R, X7S, X7T, X5R : Within ±7.5%<br>Y5V : Within ±20%  |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
|   |                              | Dissipation Factor   | X7R, X7S, X7T, X5R : 12.5%max<br>*3216 Size 100μF : 15%max<br>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       |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |
|   |                              |  | <ul style="list-style-type: none"> <li>Initial measurement</li> <li>Perform the initial measurement according to Note1 for Class II</li> <li>Measurement after test</li> <li>Perform the final measurement according to Note2</li> </ul>  |             |           |         |          |            |             |                            |            |                            |           |            |      |       |      |       |

| No.                | Item   | Specification   | Test Methods and Conditions |  |   |   |                    |  |   |                      |  |
|--------------------|--|---|-----------------------------|--|---|---|--------------------|--|---|----------------------|--|
| 9                  | High Temperature Load  | <table border="1"> <tr> <td data-bbox="300 241 451 320">Appearance</td> <td data-bbox="451 241 949 320">No defects which may affect performance</td> </tr> <tr> <td data-bbox="300 320 451 421">Capacitance Change</td> <td data-bbox="451 320 949 421">X7R, X7S, X7T, X5R : Within <math>\pm 12.5\%</math><br/>Y5V : Within <math>\pm 30\%</math></td> </tr> <tr> <td data-bbox="300 421 451 521">Dissipation Factor</td> <td data-bbox="451 421 949 521">X7R, X7S, X7T, X5R : 20%max<br/>*3216 Size 100<math>\mu</math>F : 30%max<br/>Y5V : 40%max</td> </tr> <tr> <td data-bbox="300 521 451 667">I.R</td> <td data-bbox="451 521 949 667">12.5<math>\Omega</math>·F min</td> </tr> </table>                 | Appearance                  | No defects which may affect performance  | Capacitance Change  | X7R, X7S, X7T, X5R : Within $\pm 12.5\%$<br>Y5V : Within $\pm 30\%$ | Dissipation Factor | X7R, X7S, X7T, X5R : 20%max<br>*3216 Size 100 $\mu$ F : 30%max<br>Y5V : 40%max   | I.R   | 12.5 $\Omega$ ·F min | <p>Apply 100% of the rated voltage for 1000+48/-0 hrs at the maximum operating temperature <math>\pm 3^{\circ}\text{C}</math>. The charge/discharge current is less than 50mA.</p> <p>-Initial measurement<br/>Perform the initial measurement according to Note1 for Class II</p> <p>-Measurement after test<br/>Perform the final measurement according to Note2</p> |
| Appearance         | No defects which may affect performance  |   |                             |  |   |   |                    |  |   |                      |  |
| Capacitance Change | X7R, X7S, X7T, X5R : Within $\pm 12.5\%$<br>Y5V : Within $\pm 30\%$  |   |                             |  |   |   |                    |  |   |                      |  |
| Dissipation Factor | X7R, X7S, X7T, X5R : 20%max<br>*3216 Size 100 $\mu$ F : 30%max<br>Y5V : 40%max                             |   |                             |  |   |   |                    |  |   |                      |  |
| I.R                | 12.5 $\Omega$ ·F min   |   |                             |  |   |   |                    |  |   |                      |  |
| 10                 | Bending strength   |  <p>No cracking or marking defects shall occur</p> <table border="1"> <tr> <td data-bbox="300 1216 451 1294">Capacitance Change</td> <td data-bbox="451 1216 949 1294">X7R, X7S, X7T, X5R: Within <math>\pm 12.5\%</math><br/>Y5V : Within <math>\pm 30\%</math><br/>Within +30/-40% (cap<math>\geq 10\mu</math>F)</td> </tr> </table>  | Capacitance Change          | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$<br>Y5V : Within $\pm 30\%$<br>Within +30/-40% (cap $\geq 10\mu$ F) | <p>·Substrate material<br/>: Glass EPOXY Board.</p> <p>·Thickness<br/>: 1.6mm<br/>0.8mm(0603/1005size)</p> <p>*. Test condition<br/>- Bending limit : 1mm<br/>- Pressurizing speed : 1mm/sec<br/>- Holding time : 5<math>\pm</math>1sec</p> |   |                    |  |   |                      |  |
| Capacitance Change | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$<br>Y5V : Within $\pm 30\%$<br>Within +30/-40% (cap $\geq 10\mu$ F) |   |                             |  |   |   |                    |  |   |                      |  |
| 11                 | Vibration Resistance   | <table border="1"> <tr> <td data-bbox="300 1305 451 1350">Appearance</td> <td data-bbox="451 1305 949 1350">No defects or abnormalities</td> </tr> <tr> <td data-bbox="300 1350 451 1417">Capacitance</td> <td data-bbox="451 1350 949 1417">Whin the specified tolerance</td> </tr> <tr> <td data-bbox="300 1417 451 1664">Dissipation Factor</td> <td data-bbox="451 1417 949 1664">X7R, X7S, X7T, X5R : 12.5%max<br/>*3216 Size 100<math>\mu</math>F : 15%max<br/>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<br>*3216 Size 100 $\mu$ F : 15%max<br>Y5V : 20%max | <p>*Shown in Fig. After soldering and then let sit for 24<math>\pm</math>2hr 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<br>*3216 Size 100 $\mu$ F : 15%max<br>Y5V : 20%max                           |   |                             |  |   |   |                    |  |   |                      |  |
| 12                 | Humidity Load  | <table border="1"> <tr> <td data-bbox="300 1686 451 1765">Appearance</td> <td data-bbox="451 1686 949 1765">No defects which may affect performance</td> </tr> <tr> <td data-bbox="300 1765 451 1843">Capacitance Change</td> <td data-bbox="451 1765 949 1843">X7R, X7S, X7T, X5R: Within <math>\pm 12.5\%</math><br/>Y5V : Within <math>\pm 30\%</math></td> </tr> <tr> <td data-bbox="300 1843 451 1944">Dissipation Factor</td> <td data-bbox="451 1843 949 1944">X7R, X7S, X7T, X5R : 20%max<br/>*3216 Size 100<math>\mu</math>F : 30%max<br/>Y5V : 40%max</td> </tr> <tr> <td data-bbox="300 1944 451 2056">I.R.</td> <td data-bbox="451 1944 949 2056">12.5<math>\Omega</math>·F min</td> </tr> </table> | Appearance                  | No defects which may affect performance  | Capacitance Change  | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$<br>Y5V : Within $\pm 30\%$  | Dissipation Factor | X7R, X7S, X7T, X5R : 20%max<br>*3216 Size 100 $\mu$ F : 30%max<br>Y5V : 40%max   | I.R.  | 12.5 $\Omega$ ·F min | <p>Apply the rated voltage at 40<math>\pm</math>2<math>^{\circ}\text{C}</math> and 90 to 95%RH for 500+24/-0 hrs. The charge/discharge current is less than 50mA.</p> <p>-Initial measurement<br/>Perform the initial measurement according to Note1 for Class II</p> <p>-Measurement after test<br/>Perform the final measurement according to Note2</p>              |
| Appearance         | No defects which may affect performance  |   |                             |  |   |   |                    |  |   |                      |  |
| Capacitance Change | X7R, X7S, X7T, X5R: Within $\pm 12.5\%$<br>Y5V : Within $\pm 30\%$   |   |                             |  |   |   |                    |  |   |                      |  |
| Dissipation Factor | X7R, X7S, X7T, X5R : 20%max<br>*3216 Size 100 $\mu$ F : 30%max<br>Y5V : 40%max                             |   |                             |  |   |   |                    |  |   |                      |  |
| I.R.               | 12.5 $\Omega$ ·F min   |   |                             |  |   |   |                    |  |   |                      |  |

| No. | Item  | Specification |                 |                    |                 | Test Methods and Conditions   |
|-----|---|---------------|-----------------|--------------------|-----------------|---|
| 13  | Capacitance<br>Temperature<br>Characteristics | Char.         | Temp. Range     | Reference<br>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 | $\Phi 178 \pm 2$  | $\Phi 50 \text{Min}$ | $\Phi 13 \pm 0.5$ | $\Phi 21 \pm 0.8$ | $2 \pm 0.5$ | $10 \pm 1.5$ |
|           | 4520~4532 | $\Phi 180 +0, -3$ | $\Phi 60 -0, +1$     | $\Phi 13 \pm 0.2$ | $\Phi 57 -0 +1$   | $3 \pm 0.2$ | $13 \pm 0.5$ |
| 13 " REEL | 1005~3225 | $\Phi 330 \pm 2$  | $\Phi 70 \text{Min}$ | $\Phi 13 \pm 0.5$ | $\Phi 21 \pm 0.8$ | $2 \pm 0.5$ | $10 \pm 1.5$ |

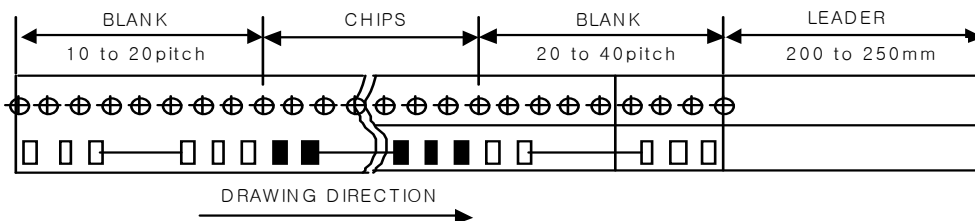
(4) Number of Package

| TYPE   | EIA CODE | 7"            | 13"            |
|--------|----------|---------------|----------------|
|        |          | Qt/REEL       | Qt/REEL        |
| CS0603 | CC0201   | 15,000        |                |
| CS1005 | CC0402   | 10,000        | 50,000         |
| CS1608 | CC0603   | 4,000         | 15,000         |
| CS2012 | CC0805   | 3,000 ~ 4,000 | 8,000 ~ 15,000 |
| 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   | $0.67 \pm 0.05$ | $0.37 \pm 0.05$ | $8.0 \pm 0.3$  | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $2.0 \pm 0.05$                 | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS1005 | CC0402   | $1.15 \pm 0.1$  | $0.65 \pm 0.1$  | $8.0 \pm 0.3$  | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $2.0 \pm 0.05$                 | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS1608 | CC0603   | $1.9 \pm 0.2$   | $1.10 \pm 0.2$  | $8.0 \pm 0.3$  | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $4.0 \pm 0.1$                  | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS2012 | CC0805   | $2.4 \pm 0.2$   | $1.65 \pm 0.2$  | $8.0 \pm 0.3$  | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $4.0 \pm 0.1$                  | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS3216 | CC1206   | $3.6 \pm 0.2$   | $2.00 \pm 0.2$  | $8.0 \pm 0.3$  | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $4.0 \pm 0.1$                  | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS3225 | CC1210   | $3.6 \pm 0.2$   | $2.80 \pm 0.2$  | $8.0 \pm 0.3$  | $3.5 \pm 0.05$ | $1.75 \pm 0.1$ | $4.0 \pm 0.1$                  | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS4520 | CC1808   | $4.8 \pm 0.2$   | $2.3 \pm 0.2$   | $12.0 \pm 0.3$ | $5.5 \pm 0.1$  | $1.75 \pm 0.1$ | $4.0 \pm 0.1$<br>$8.0 \pm 0.1$ | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |
| CS4532 | CC1812   | $4.9 \pm 0.2$   | $3.6 \pm 0.2$   | $12.0 \pm 0.3$ | $5.5 \pm 0.1$  | $1.75 \pm 0.1$ | $8.0 \pm 0.1$                  | $2.0 \pm 0.1$ | $4.0 \pm 0.1$ | $1.5 \pm 0.1$ |





## 6. Caution

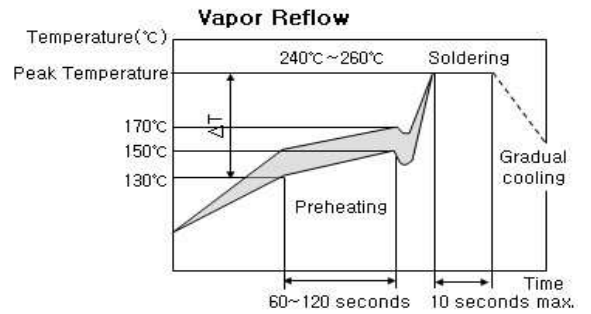
### ▶ Reflow Soldering

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( $\Delta T$ ) within the range recommended in Table 1.

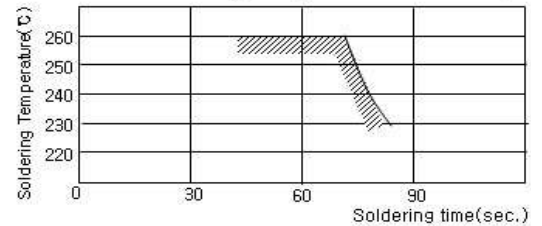
Table 1

| 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,  $\text{Cr}^{+6}$ , 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 BaTiO<sub>3</sub>)

'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:

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

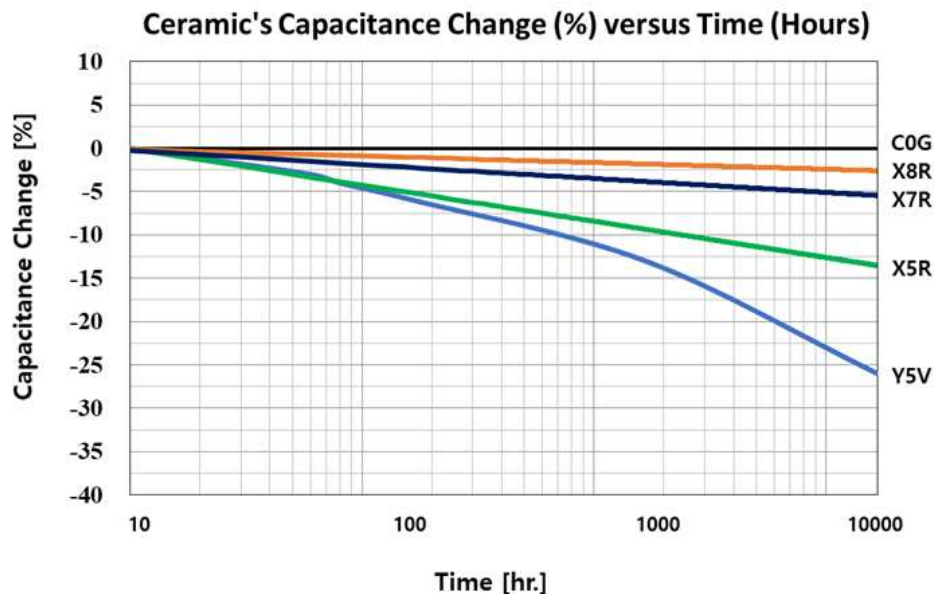
where :

$C_t$  = 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