



## Surface Mount Multilayer Chip Capacitors for Commodity Solutions

Below tables are test procedures and requirements unless specified in detail datasheet.

| VJ...W1BC TEST PROCEDURES AND REQUIREMENTS |  |   |   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|--|--|---|---|---------------|-----------|------------------------|--|-------------|-------|-----|---|-----|-------------------------|------|--|------|-------|------|---|------|-------|-----|--|-----|---|------|--|------|-------|-----|---|------|--|------|-----|------|---|------|--|-------|------|------|--|------|-------------------------|-----|------|---|---|---------------|-----------|------------------------|--|-------------|-----|-----|---|------|-----|---|---|------|-----|-----|--|-----|---|---------------------------|-----|-----|---|--------|--------------------------|------------------------------|-----|--------|---|------|--------|------|--------------------------|-------|------|---|---|
| TEST                                       | PROCEDURE  | REQUIREMENTS  |   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 1) Visual and mechanical                   |  | <ul style="list-style-type: none"> <li>No remarkable defect</li> <li>Dimensions should confirm to individual specification sheet</li> </ul>   |   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 2) Capacitance                             |  | <ul style="list-style-type: none"> <li>Shall not exceed the limits given in the detailed specification</li> </ul> <p><b>C0G (NP0):</b> Cap. <math>\geq 30</math> pF; Q <math>\geq 1000</math><br/>Cap. <math>&lt; 30</math> pF; Q <math>\geq 400 + 20 C</math></p> <p><b>X5R, X7R:</b></p> <table border="1"> <thead> <tr> <th>RATED VOLTAGE</th> <th>DF <math>\leq</math></th> <th colspan="2">EXCEPTION OF DF <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td rowspan="3"><math>\geq 50</math> V</td> <td rowspan="3">2.5 %</td> <td>3 %</td> <td>0201 (50 V); 0603 <math>\geq 0.047</math> <math>\mu</math>F;<br/>0805 <math>\geq 0.18</math> <math>\mu</math>F; 1206 <math>\geq 0.47</math> <math>\mu</math>F</td> </tr> <tr> <td>5 %</td> <td>1210 <math>\geq 4.7</math> <math>\mu</math>F</td> </tr> <tr> <td>10 %</td> <td>0603 <math>\geq 1</math> <math>\mu</math>F; 0805 <math>\geq 1</math> <math>\mu</math>F;<br/>1206 <math>\geq 2.2</math> <math>\mu</math>F; 1210 <math>\geq 10</math> <math>\mu</math>F</td> </tr> <tr> <td>35 V</td> <td>3.5 %</td> <td>10 %</td> <td>0805 <math>\geq 2.2</math> <math>\mu</math>F; 1210 <math>\geq 10</math> <math>\mu</math>F</td> </tr> <tr> <td rowspan="3">25 V</td> <td rowspan="3">3.5 %</td> <td>5 %</td> <td>0201 <math>\geq 0.01</math> <math>\mu</math>F; 0805 <math>\geq 1</math> <math>\mu</math>F;<br/>1210 <math>\geq 10</math> <math>\mu</math>F</td> </tr> <tr> <td>7 %</td> <td>0603 <math>\geq 0.33</math> <math>\mu</math>F; 1206 <math>\geq 4.7</math> <math>\mu</math>F</td> </tr> <tr> <td>10 %</td> <td>0402 <math>\geq 0.10</math> <math>\mu</math>F; 0603 <math>\geq 0.47</math> <math>\mu</math>F;<br/>0805 <math>\geq 2.2</math> <math>\mu</math>F; 1206 <math>\geq 6.8</math> <math>\mu</math>F;<br/>1210 <math>\geq 22</math> <math>\mu</math>F</td> </tr> <tr> <td rowspan="2">16 V</td> <td rowspan="2">3.5 %</td> <td>5 %</td> <td>0201 <math>\geq 0.01</math> <math>\mu</math>F; 0402 <math>\geq 0.033</math> <math>\mu</math>F;<br/>0603 <math>\geq 0.15</math> <math>\mu</math>F; 0805 <math>\geq 0.68</math> <math>\mu</math>F;<br/>1206 <math>\geq 2.2</math> <math>\mu</math>F; 1210 <math>\geq 4.7</math> <math>\mu</math>F</td> </tr> <tr> <td>10 %</td> <td>0402 <math>\geq 0.22</math> <math>\mu</math>F; 0603 <math>\geq 0.68</math> <math>\mu</math>F;<br/>0805 <math>\geq 2.2</math> <math>\mu</math>F; 1206 <math>\geq 4.7</math> <math>\mu</math>F;<br/>1210 <math>\geq 22</math> <math>\mu</math>F</td> </tr> <tr> <td rowspan="2">10 V</td> <td rowspan="2">5 %</td> <td>10 %</td> <td>0201 <math>\geq 0.012</math> <math>\mu</math>F; 0402 <math>\geq 0.33</math> <math>\mu</math>F;<br/>0603 <math>\geq 0.33</math> <math>\mu</math>F; 0805 <math>\geq 2.2</math> <math>\mu</math>F;<br/>1206 <math>\geq 2.2</math> <math>\mu</math>F; 1210 <math>\geq 22</math> <math>\mu</math>F</td> </tr> <tr> <td>15 %</td> <td>0201 <math>\geq 0.1</math> <math>\mu</math>F; 0402 <math>\geq 1</math> <math>\mu</math>F</td> </tr> <tr> <td rowspan="2">6.3 V</td> <td rowspan="2">10 %</td> <td>15 %</td> <td>0201 <math>\geq 0.1</math> <math>\mu</math>F; 0402 <math>\geq 1</math> <math>\mu</math>F;<br/>0603 <math>\geq 10</math> <math>\mu</math>F; 0805 <math>\geq 4.7</math> <math>\mu</math>F;<br/>1206 <math>\geq 47</math> <math>\mu</math>F; 1210 <math>\geq 100</math> <math>\mu</math>F</td> </tr> <tr> <td>20 %</td> <td>0402 <math>\geq 2.2</math> <math>\mu</math>F</td> </tr> <tr> <td>4 V</td> <td>15 %</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p><b>Y5V:</b></p> <table border="1"> <thead> <tr> <th>RATED VOLTAGE</th> <th>DF <math>\leq</math></th> <th colspan="2">EXCEPTION OF DF <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq 50</math> V</td> <td>5 %</td> <td>7 %</td> <td>0603 <math>\geq 0.1</math> <math>\mu</math>F; 0805 <math>\geq 0.47</math> <math>\mu</math>F;<br/>1206 <math>\geq 4.7</math> <math>\mu</math>F</td> </tr> <tr> <td>35 V</td> <td>7 %</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">25 V</td> <td rowspan="2">5 %</td> <td>7 %</td> <td>0402 <math>\geq 0.047</math> <math>\mu</math>F; 0603 <math>\geq 0.1</math> <math>\mu</math>F;<br/>0805 <math>\geq 0.33</math> <math>\mu</math>F; 1206 <math>\geq 1</math> <math>\mu</math>F;<br/>1210 <math>\geq 4.7</math> <math>\mu</math>F</td> </tr> <tr> <td>9 %</td> <td>0402 <math>\geq 0.068</math> <math>\mu</math>F; 0603 <math>\geq 0.47</math> <math>\mu</math>F;<br/>1206 <math>\geq 4.7</math> <math>\mu</math>F; 1210 <math>\geq 22</math> <math>\mu</math>F</td> </tr> <tr> <td rowspan="2">16 V<br/>C <math>&lt; 1.0</math> <math>\mu</math>F</td> <td rowspan="2">7 %</td> <td>9 %</td> <td>0402 <math>\geq 0.068</math> <math>\mu</math>F; 0603 <math>\geq 0.68</math> <math>\mu</math>F</td> </tr> <tr> <td>12.5 %</td> <td>0402 <math>\geq 0.22</math> <math>\mu</math>F</td> </tr> <tr> <td>16 V<br/>C <math>\geq 1.0</math> <math>\mu</math>F</td> <td>9 %</td> <td>12.5 %</td> <td>0603 <math>\geq 2.2</math> <math>\mu</math>F; 0805 <math>\geq 3.3</math> <math>\mu</math>F;<br/>1206 <math>\geq 10</math> <math>\mu</math>F; 1210 <math>\geq 22</math> <math>\mu</math>F</td> </tr> <tr> <td>10 V</td> <td>12.5 %</td> <td>20 %</td> <td>0402 <math>\geq 0.47</math> <math>\mu</math>F</td> </tr> <tr> <td>6.3 V</td> <td>20 %</td> <td>-</td> <td>-</td> </tr> </tbody> </table> |   | RATED VOLTAGE | DF $\leq$ | EXCEPTION OF DF $\leq$ |  | $\geq 50$ V | 2.5 % | 3 % | 0201 (50 V); 0603 $\geq 0.047$ $\mu$ F;<br>0805 $\geq 0.18$ $\mu$ F; 1206 $\geq 0.47$ $\mu$ F | 5 % | 1210 $\geq 4.7$ $\mu$ F | 10 % | 0603 $\geq 1$ $\mu$ F; 0805 $\geq 1$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 10$ $\mu$ F | 35 V | 3.5 % | 10 % | 0805 $\geq 2.2$ $\mu$ F; 1210 $\geq 10$ $\mu$ F | 25 V | 3.5 % | 5 % | 0201 $\geq 0.01$ $\mu$ F; 0805 $\geq 1$ $\mu$ F;<br>1210 $\geq 10$ $\mu$ F | 7 % | 0603 $\geq 0.33$ $\mu$ F; 1206 $\geq 4.7$ $\mu$ F | 10 % | 0402 $\geq 0.10$ $\mu$ F; 0603 $\geq 0.47$ $\mu$ F;<br>0805 $\geq 2.2$ $\mu$ F; 1206 $\geq 6.8$ $\mu$ F;<br>1210 $\geq 22$ $\mu$ F | 16 V | 3.5 % | 5 % | 0201 $\geq 0.01$ $\mu$ F; 0402 $\geq 0.033$ $\mu$ F;<br>0603 $\geq 0.15$ $\mu$ F; 0805 $\geq 0.68$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 4.7$ $\mu$ F | 10 % | 0402 $\geq 0.22$ $\mu$ F; 0603 $\geq 0.68$ $\mu$ F;<br>0805 $\geq 2.2$ $\mu$ F; 1206 $\geq 4.7$ $\mu$ F;<br>1210 $\geq 22$ $\mu$ F | 10 V | 5 % | 10 % | 0201 $\geq 0.012$ $\mu$ F; 0402 $\geq 0.33$ $\mu$ F;<br>0603 $\geq 0.33$ $\mu$ F; 0805 $\geq 2.2$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 22$ $\mu$ F | 15 % | 0201 $\geq 0.1$ $\mu$ F; 0402 $\geq 1$ $\mu$ F | 6.3 V | 10 % | 15 % | 0201 $\geq 0.1$ $\mu$ F; 0402 $\geq 1$ $\mu$ F;<br>0603 $\geq 10$ $\mu$ F; 0805 $\geq 4.7$ $\mu$ F;<br>1206 $\geq 47$ $\mu$ F; 1210 $\geq 100$ $\mu$ F | 20 % | 0402 $\geq 2.2$ $\mu$ F | 4 V | 15 % | - | - | RATED VOLTAGE | DF $\leq$ | EXCEPTION OF DF $\leq$ |  | $\geq 50$ V | 5 % | 7 % | 0603 $\geq 0.1$ $\mu$ F; 0805 $\geq 0.47$ $\mu$ F;<br>1206 $\geq 4.7$ $\mu$ F | 35 V | 7 % | - | - | 25 V | 5 % | 7 % | 0402 $\geq 0.047$ $\mu$ F; 0603 $\geq 0.1$ $\mu$ F;<br>0805 $\geq 0.33$ $\mu$ F; 1206 $\geq 1$ $\mu$ F;<br>1210 $\geq 4.7$ $\mu$ F | 9 % | 0402 $\geq 0.068$ $\mu$ F; 0603 $\geq 0.47$ $\mu$ F;<br>1206 $\geq 4.7$ $\mu$ F; 1210 $\geq 22$ $\mu$ F | 16 V<br>C $< 1.0$ $\mu$ F | 7 % | 9 % | 0402 $\geq 0.068$ $\mu$ F; 0603 $\geq 0.68$ $\mu$ F | 12.5 % | 0402 $\geq 0.22$ $\mu$ F | 16 V<br>C $\geq 1.0$ $\mu$ F | 9 % | 12.5 % | 0603 $\geq 2.2$ $\mu$ F; 0805 $\geq 3.3$ $\mu$ F;<br>1206 $\geq 10$ $\mu$ F; 1210 $\geq 22$ $\mu$ F | 10 V | 12.5 % | 20 % | 0402 $\geq 0.47$ $\mu$ F | 6.3 V | 20 % | - | - |
| RATED VOLTAGE                              | DF $\leq$  | EXCEPTION OF DF $\leq$  |   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| $\geq 50$ V                                | 2.5 %  | 3 %   | 0201 (50 V); 0603 $\geq 0.047$ $\mu$ F;<br>0805 $\geq 0.18$ $\mu$ F; 1206 $\geq 0.47$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 5 %   | 1210 $\geq 4.7$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 10 %  | 0603 $\geq 1$ $\mu$ F; 0805 $\geq 1$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 10$ $\mu$ F  |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 35 V                                       | 3.5 %  | 10 %  | 0805 $\geq 2.2$ $\mu$ F; 1210 $\geq 10$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 25 V                                       | 3.5 %  | 5 %   | 0201 $\geq 0.01$ $\mu$ F; 0805 $\geq 1$ $\mu$ F;<br>1210 $\geq 10$ $\mu$ F  |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 7 %   | 0603 $\geq 0.33$ $\mu$ F; 1206 $\geq 4.7$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 10 %  | 0402 $\geq 0.10$ $\mu$ F; 0603 $\geq 0.47$ $\mu$ F;<br>0805 $\geq 2.2$ $\mu$ F; 1206 $\geq 6.8$ $\mu$ F;<br>1210 $\geq 22$ $\mu$ F                              |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 16 V                                       | 3.5 %  | 5 %   | 0201 $\geq 0.01$ $\mu$ F; 0402 $\geq 0.033$ $\mu$ F;<br>0603 $\geq 0.15$ $\mu$ F; 0805 $\geq 0.68$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 4.7$ $\mu$ F |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 10 %  | 0402 $\geq 0.22$ $\mu$ F; 0603 $\geq 0.68$ $\mu$ F;<br>0805 $\geq 2.2$ $\mu$ F; 1206 $\geq 4.7$ $\mu$ F;<br>1210 $\geq 22$ $\mu$ F                              |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 10 V                                       | 5 %  | 10 %  | 0201 $\geq 0.012$ $\mu$ F; 0402 $\geq 0.33$ $\mu$ F;<br>0603 $\geq 0.33$ $\mu$ F; 0805 $\geq 2.2$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 22$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 15 %  | 0201 $\geq 0.1$ $\mu$ F; 0402 $\geq 1$ $\mu$ F  |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 6.3 V                                      | 10 %   | 15 %  | 0201 $\geq 0.1$ $\mu$ F; 0402 $\geq 1$ $\mu$ F;<br>0603 $\geq 10$ $\mu$ F; 0805 $\geq 4.7$ $\mu$ F;<br>1206 $\geq 47$ $\mu$ F; 1210 $\geq 100$ $\mu$ F          |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 20 %  | 0402 $\geq 2.2$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 4 V  | 15 %   | -   | -   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| RATED VOLTAGE                              | DF $\leq$  | EXCEPTION OF DF $\leq$  |   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| $\geq 50$ V                                | 5 %  | 7 %   | 0603 $\geq 0.1$ $\mu$ F; 0805 $\geq 0.47$ $\mu$ F;<br>1206 $\geq 4.7$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 35 V                                       | 7 %  | -   | -   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 25 V                                       | 5 %  | 7 %   | 0402 $\geq 0.047$ $\mu$ F; 0603 $\geq 0.1$ $\mu$ F;<br>0805 $\geq 0.33$ $\mu$ F; 1206 $\geq 1$ $\mu$ F;<br>1210 $\geq 4.7$ $\mu$ F                              |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 9 %   | 0402 $\geq 0.068$ $\mu$ F; 0603 $\geq 0.47$ $\mu$ F;<br>1206 $\geq 4.7$ $\mu$ F; 1210 $\geq 22$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 16 V<br>C $< 1.0$ $\mu$ F                  | 7 %  | 9 %   | 0402 $\geq 0.068$ $\mu$ F; 0603 $\geq 0.68$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
|  |  | 12.5 %  | 0402 $\geq 0.22$ $\mu$ F  |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 16 V<br>C $\geq 1.0$ $\mu$ F               | 9 %  | 12.5 %  | 0603 $\geq 2.2$ $\mu$ F; 0805 $\geq 3.3$ $\mu$ F;<br>1206 $\geq 10$ $\mu$ F; 1210 $\geq 22$ $\mu$ F   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 10 V                                       | 12.5 %   | 20 %  | 0402 $\geq 0.47$ $\mu$ F  |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 6.3 V                                      | 20 %   | -   | -   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |
| 3) Q/DF (dissipation factor)               | <p>Class 1: C0G (NP0)<br/>Cap. <math>\leq 1000</math> pF; <math>1.0 V_{RMS} \pm 0.2 V_{RMS}</math>;<br/>1 MHz <math>\pm 10</math> %<br/>Cap. <math>&gt; 1000</math> pF; <math>1.0 V_{RMS} \pm 0.2 V_{RMS}</math>;<br/>1 kHz <math>\pm 10</math> %</p> <p>Class 2: X7R, X5R, Y5V<br/>Cap. <math>\leq 10</math> <math>\mu</math>F; <math>1.0 V_{RMS} \pm 0.2 V_{RMS}</math>;<br/>1 kHz <math>\pm 10</math> % <sup>(1)</sup></p> <p>Cap. <math>&gt; 10</math> <math>\mu</math>F; <math>0.5 V_{RMS} \pm 0.2 V_{RMS}</math>;<br/>120 Hz <math>\pm 20</math> %</p> <p><b>Note</b><br/><sup>(1)</sup> Test conditions<br/><math>0.5 V_{RMS} \pm 0.2 V_{RMS}</math>; 1 kHz <math>\pm 10</math> %</p> <p>X7R: 0603: <math>\geq 2.2</math> <math>\mu</math>F/10 V<br/>0805: 10 <math>\mu</math>F/6.3 V and 10 V</p> <p>X5R: 0201: <math>\geq 220</math> nF/6.3 V<br/>0402: <math>\geq 4.7</math> <math>\mu</math>F/6.3 V<br/>0402: <math>\geq 2.2</math> <math>\mu</math>F/10 V<br/>0603: 10 <math>\mu</math>F/6.3 V</p> |   |   |               |           |                        |  |             |       |     |   |     |                         |      |  |      |       |      |   |      |       |     |  |     |   |      |  |      |       |     |   |      |  |      |     |      |   |      |  |       |      |      |  |      |                         |     |      |   |   |               |           |                        |  |             |     |     |   |      |     |   |   |      |     |     |  |     |   |                           |     |     |   |        |                          |                              |     |        |   |      |        |      |                          |       |      |   |   |



| VJ...W1BC TEST PROCEDURES AND REQUIREMENTS |   |   |  |   |
|--|---|---|--|---|
| TEST                                       | PROCEDURE   |   | REQUIREMENTS   |   |
| 4) Dielectric strength                     | <ul style="list-style-type: none"> <li>To apply voltage (<math>\leq 100</math> V) 250 %</li> <li>Duration: 1 s to 5 s</li> <li>Charge and discharge current less than 50 mA</li> </ul>  |   | <ul style="list-style-type: none"> <li>No evidence of damage or flash-over during test</li> </ul>  |   |
|  | <ul style="list-style-type: none"> <li>To apply voltage<br/>200 V to 300 V <math>\geq 2</math> times <math>V_{DC}</math><br/>500 V to 999 V <math>\geq 1.5</math> times <math>V_{DC}</math><br/>1000 V to 3000 V <math>\geq 1.2</math> times <math>V_{DC}</math></li> <li>Cut-off, set at 10 mA</li> <li>TEST = 15 s</li> <li>RAMP = 0</li> </ul> |   |  |   |
| 5) Insulation resistance                   | Rated voltage $\leq 100$ V:<br>To apply rated voltage for max. 120 s  |   | 10 G $\Omega$ or $R \times C \geq 500$ $\Omega$ F whichever is smaller<br><b>Class 2 (X5R, X7R, Y5V):</b>                                  |   |
|  |   |   | <b>RATED VOLTAGE</b>   | <b>INSULATION RESISTANCE</b>  |
|  |   |   | 100 V: X7R   | 10 G $\Omega$ or<br>$R \times C \geq 100$ $\Omega$ F<br>whichever is less |
|  |   |   | 50 V: 0603 $\geq 1$ $\mu$ F; 0805 $\geq 1$ $\mu$ F;<br>1206 $\geq 2.2$ $\mu$ F; 1210 $\geq 4.7$ $\mu$ F                                    |   |
|  |   |   | 35 V: 0805 $\geq 2.2$ $\mu$ F; 1210 $\geq 10$ $\mu$ F  |   |
|  |   |   | 25 V: 0402 $\geq 1$ $\mu$ F; 0603 $\geq 2.2$ $\mu$ F;<br>0805 $\geq 2.2$ $\mu$ F; 1206 $\geq 10$ $\mu$ F;<br>1210 $\geq 10$ $\mu$ F        |   |
|  |   |   | 16 V: 0402 $\geq 0.22$ $\mu$ F; 0603 $\geq 1$ $\mu$ F;<br>0805 $\geq 2.2$ $\mu$ F; 1206 $\geq 10$ $\mu$ F;<br>1210 $\geq 47$ $\mu$ F       |   |
|  |   | 10 V: 0201 $\geq 47$ nF; 0402 $\geq 0.47$ $\mu$ F;<br>0603 $\geq 0.47$ $\mu$ F; 0805 $\geq 2.2$ $\mu$ F;<br>1206 $\geq 4.7$ $\mu$ F; 1210 $\geq 47$ $\mu$ F |  |   |
|  |   | 6.3 V; 4 V  |  |   |
|  | Rated voltage: 200 V to 630 V   | To apply rated voltage (500 V max.) for 60 s  | $> 10$ G $\Omega$ or $R \times C > 100$ $\Omega$ F whichever is smaller  |   |
|  | Rated voltage: $> 630$ V  | To apply 500 V for 60 s   | $> 10$ G $\Omega$  |   |
| 6) Temperature coefficient                 | With no electrical load:  |   |  |   |
|  | T.C.  | Operating Temp.   | T.C.   | Capacitance change  |
|  | C0G (NP0)   | - 55 $^{\circ}$ C to 125 $^{\circ}$ C at 25 $^{\circ}$ C  | C0G (NP0)  | Within $\pm 30$ ppm/ $^{\circ}$ C   |
|  | X7R   | - 55 $^{\circ}$ C to 125 $^{\circ}$ C at 25 $^{\circ}$ C  | X7R  | Within $\pm 15$ %   |
|  | X5R   | - 55 $^{\circ}$ C to 85 $^{\circ}$ C at 25 $^{\circ}$ C   | X5R  | Within $\pm 15$ %   |
|  | Y5V   | - 25 $^{\circ}$ C to 85 $^{\circ}$ C at 20 $^{\circ}$ C   | Y5V  | Within + 30 %/- 80 %  |
| 7) Adhesive strength of termination        | <ul style="list-style-type: none"> <li>Pressurizing force:<br/>0201: 2N<br/>0402 and 0603: 5 N<br/><math>&gt; 0603</math>: 10 N</li> <li>Test time 10 s <math>\pm</math> 1 s</li> </ul>   |   | <ul style="list-style-type: none"> <li>No remarkable damage or removal of the terminations</li> </ul>                                      |   |
| 8) Vibration resistance                    | <ul style="list-style-type: none"> <li>Vibration frequency: 10 Hz/min to 55 Hz/min</li> <li>Total amplitude: 1.5 mm</li> <li>Test time: 6 h (2 h each in 3 mutually perpendicular directions)</li> </ul>  |   | <ul style="list-style-type: none"> <li>No remarkable damage</li> <li>Capacitance change and Q/DF: to meet initial specification</li> </ul> |   |
| 9) Solderability                           | <ul style="list-style-type: none"> <li>Solder temperature: 235 <math>^{\circ}</math>C <math>\pm</math> 5 <math>^{\circ}</math>C</li> <li>Dipping time: 2 s <math>\pm</math> 0.5 s</li> </ul>  |   | 95 % minimum coverage of all metallized area   |   |



| VJ...W1BC TEST PROCEDURES AND REQUIREMENTS   |   |                              |   |             |
|--|---|------------------------------|---|-------------|
| TEST   | PROCEDURE   |                              | REQUIREMENTS  |             |
| 10) Bending test   | <ul style="list-style-type: none"> <li>The middle part of the substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per s until the deflection becomes 1 mm and then the pressure shall be maintained for 5 s ± 1 s</li> <li>Measurement to be made after keeping at room temperature for 24 h ± 2 h</li> </ul>   |                              | <ul style="list-style-type: none"> <li>No remarkable damage</li> <li>Capacitance change:<br/>C0G (NP0): within ± 5.0 % or ± 0.5 pF whichever is larger<br/>X7R, X5R: within ± 12.5 %<br/>Y5V: within ± 30 %</li> </ul> (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test) |             |
| 11) Resistance to soldering heat   | <ul style="list-style-type: none"> <li>Solder temperature: 260 °C ± 5 °C</li> <li>Dipping time: 10 s ± 1 s</li> <li>Preheating: 120 °C to 150 °C for 1 min before immerse the capacitor in a eutectic solder</li> <li>Before initial measurement (class 2 only):<br/>Perform 150 °C + 0 °C/ - 10 °C for 1 h and then set for 24 h ± 2 h at room temperature</li> <li>Measurement to be made after keeping at room temperature for 24 h ± 2 h</li> </ul> |                              | <ul style="list-style-type: none"> <li>No remarkable damage</li> <li>Capacitance change:<br/>C0G (NP0): within ± 2.5 % or ± 0.25 pF whichever is larger<br/>X7R, X5R: within ± 7.5 %<br/>Y5V: within ± 20 %</li> <li>Q/DF, I.R. and dielectric strength: To meet initial requirements</li> <li>25 % maximum leaching on each edge</li> </ul>                        |             |
| 12) Temperature cycle  | <ul style="list-style-type: none"> <li>Conduct the 5 cycles according to the temperature and time</li> </ul>  |                              | <ul style="list-style-type: none"> <li>No remarkable damage</li> <li>Capacitance change:<br/>C0G (NP0): within ± 2.5 % or ± 0.25 pF whichever is larger<br/>X7R, X5R: within ± 7.5 %<br/>Y5V: within ± 20 %</li> <li>Q/DF, I.R. and dielectric strength: To meet initial requirements</li> </ul>  |             |
|  | Step  | Temperature (°C)             |   | Time (min.) |
|  | 1   | Min. operating temp. + 0/- 3 |   | 30 ± 3      |
|  | 2   | Room temperature             |   | 2 ~ 3       |
|  | 3   | Max. operating temp. + 3/- 0 |   | 30 ± 3      |
|  | 4   | Room temperature             |   | 2 ~ 3       |
| <ul style="list-style-type: none"> <li>Before initial measurement (class 2 only):<br/>Perform 150 °C + 0 °C/ - 10 °C for 1 h and then set for 24 h ± 2 h at room temperature</li> <li>Measurement to be made after keeping at room temperature for 24 h ± 2 h</li> </ul> |   |                              |   |             |



| VJ....W1BC TEST PROCEDURES AND REQUIREMENTS  |  |   |  |                          |   |
|--|--|---|--|--------------------------|---|
| TEST   | PROCEDURE  | REQUIREMENTS  |  |                          |   |
| 13) Humidity<br>(damp heat)<br>steady state  | <ul style="list-style-type: none"> <li>Test temperature: 40 °C ± 2 °C</li> <li>Humidity: 90 % to 95 % RH</li> <li>Test time: 500 h + 24 h/- 0 h</li> <li>Before measurement (class 2 only): Perform 150 °C + 0 °C/ - 10 °C for 1 h and then set for 24 h ± 2 h at room temperature</li> <li>Measurement to be made after keeping at room temperature for 24 h ± 2 h</li> </ul> | <ul style="list-style-type: none"> <li>No remarkable damage</li> <li>Capacitance change:<br/>C0G (NP0): within ± 5.0 % or ± 0.5 pF whichever is larger<br/>X7R, X5R: ≥ 10 V within ± 12.5 %; 6.3 V, within ± 25 %<br/>Y5V: ≥ 10 V within ± 30 %, 6.3 V within + 30 %/- 40 %</li> <li>Q/DF value:<br/>C0G (NP0): more than 30 pF: Q ≥ 350<br/>10 pF ≤ C ≤ 30 pF: Q ≥ 275 + 2.5 C;<br/>Less than 10 pF: Q ≥ 200 + 10 C</li> </ul> |  |                          |   |
|  |  | <b>X5R, X7R:</b>  |  |                          |   |
|  |  | <b>RATED VOLTAGE</b>  | <b>DF ≤</b>  | <b>EXCEPTION OF DF ≤</b> |   |
|  |  | ≥ 50 V  | 3 %  | 6 %                      | 0201 (50 V); 0603 ≥ 0.047 μF; 0805 ≥ 0.18 μF; 1206 ≥ 0.47 μF                                |
|  |  |   |  | 10 %                     | 1210 ≥ 4.7 μF   |
|  |  |   |  | 20 %                     | 0603 ≥ 1 μF; 0805 ≥ 1 μF; 1206 ≥ 2.2 μF; 1210 ≥ 10 μF                                       |
|  |  | 35 V  | 5 %  | 20 %                     | 0805 ≥ 2.2 μF; 1210 ≥ 10 μF   |
|  |  | 25 V  | 5 %  | 10 %                     | 0201 ≥ 0.01 μF; 0805 ≥ 1 μF; 1210 ≥ 10 μF   |
|  |  |   |  | 14 %                     | 0603 ≥ 0.33 μF; 1206 ≥ 4.7 μF   |
|  |  |   |  | 15 %                     | 0402 ≥ 0.10 μF; 0603 ≥ 0.47 μF; 0805 ≥ 2.2 μF; 1206 ≥ 6.8 μF; 1210 ≥ 22 μF                  |
|  |  | 16 V  | 5 %  | 10 %                     | 0603 ≥ 0.15 μF; 0805 ≥ 0.68 μF; 1206 ≥ 2.2 μF; 1210 ≥ 4.7 μF                                |
|  |  |   |  | 15 %                     | 0201 ≥ 0.01 μF; 0402 ≥ 0.033 μF; 0603 ≥ 0.68 μF; 0805 ≥ 2.2 μF; 1206 ≥ 4.7 μF; 1210 ≥ 22 μF |
|  |  | 10 V  | 7.5 %  | 15 %                     | 0201 ≥ 0.012 μF; 0402 ≥ 0.33 μF; 0603 ≥ 0.33 μF; 0805 ≥ 2.2 μF; 1206 ≥ 2.2 μF; 1210 ≥ 22 μF |
|  |  |   |  | 20 %                     | 0201 ≥ 0.1 μF; 0402 ≥ 1 μF  |
|  |  | 6.3 V   | 15 %   | 30 %                     | 0201 ≥ 0.1 μF; 0402 ≥ 1 μF; 0603 ≥ 10 μF; 0805 ≥ 4.7 μF; 1206 ≥ 47 μF; 1210 ≥ 100 μF        |
|  |  | 4 V   | 20 %   | -                        | -   |
|  |  | <b>Y5V:</b>   |  |                          |   |
|  |  | <b>RATED VOLTAGE</b>  | <b>DF ≤</b>  | <b>EXCEPTION OF DF ≤</b> |   |
|  |  | ≥ 50 V  | 7.5 %  | 10 %                     | 0603 ≥ 0.1 μF; 0805 ≥ 0.47 μF; 1206 ≥ 4.7 μF  |
|  |  | 35 V  | 10 %   | -                        | -   |
|  |  | 25 V  | 7.5 %  | 10 %                     | 0402 ≥ 0.047 μF; 0603 ≥ 0.1 μF; 0805 ≥ 0.33 μF; 1206 ≥ 1 μF; 1210 ≥ 4.7 μF                  |
|  |  |   |  | 15 %                     | 0402 ≥ 0.068 μF; 0603 ≥ 0.47 μF; 1206 ≥ 4.7 μF; 1210 ≥ 22 μF                                |
|  |  | 16 V<br>C < 1.0 μF  | 10 %   | 12.5 %                   | 0402 ≥ 0.068 μF; 0603 ≥ 0.68 μF   |
|  |  |   |  | 20 %                     | 0402 ≥ 0.22 μF  |
| 16 V<br>C ≥ 1.0 μF   | 12.5 %   | 20 %  | 0603 ≥ 2.2 μF; 0805 ≥ 3.3 μF; 1206 ≥ 10 μF; 1210 ≥ 22 μF |                          |   |
| 10 V   | 20 %   | 30 %  | 0402 ≥ 0.47 μF   |                          |   |
| 6.3 V  | 30 %   | -   | -  |                          |   |
|  |  | <ul style="list-style-type: none"> <li>I.R.: ≥ 10 V: 1 GΩ or R x C ≥ 50 ΩF whichever is smaller</li> </ul>  |  |                          |   |
| <b>CLASS 2 (X5R, X7R, Y5V):</b>  |  |   |  |                          |   |
| <b>RATED VOLTAGE</b>   |  |   | <b>INSULATION RESISTANCE</b>                             |                          |   |
| 100 V: X7R   |  |   | 1 GΩ or<br>R x C ≥ 10 ΩF<br>whichever is less            |                          |   |
| 50 V: 0603 ≥ 1 μF; 0805 ≥ 1 μF; 1206 ≥ 2.2 μF; 1210 ≥ 4.7 μF                                   |  |   |  |                          |   |
| 35 V: 0805 ≥ 2.2 μF; 1210 ≥ 10 μF  |  |   |  |                          |   |
| 25 V: 0402 ≥ 1 μF; 0603 ≥ 2.2 μF; 0805 ≥ 2.2 μF; 1206 ≥ 10 μF; 1210 ≥ 10 μF                    |  |   |  |                          |   |
| 16 V: 0402 ≥ 0.22 μF; 0603 ≥ 1 μF; 0805 ≥ 2.2 μF; 1206 ≥ 10 μF; 1210 ≥ 47 μF                   |  |   |  |                          |   |
| 10 V: 0201 ≥ 47 nF; 0402 ≥ 0.47 μF; 0603 ≥ 0.47 μF; 0805 ≥ 2.2 μF; 1206 ≥ 4.7 μF; 1210 ≥ 47 μF |  |   |  |                          |   |
| 6.3 V; 4 V   |  |   |  |                          |   |



| VJ....W1BC TEST PROCEDURES AND REQUIREMENTS  |   |   |  |                          |   |
|--|---|---|--|--------------------------|---|
| TEST   | PROCEDURE   | REQUIREMENTS  |  |                          |   |
| 14) Humidity (damp heat) load  | <ul style="list-style-type: none"> <li>• Test temperature: 40 °C ± 2 °C</li> <li>• Humidity: 90 % ~ 95 % RH</li> <li>• Test time: 500 h + 24 h/- 0 h</li> <li>• To apply voltage: rated voltage (max. 500 V)</li> <li>• Before initial measurement (class 2 only): Perform 150 °C + 0 °C/- 10 °C for 1h and then set for 24 h ± 2 h at room temperature</li> <li>• Measurement to be made after keeping at room temperature for 24 h ± 2 h</li> </ul> | <ul style="list-style-type: none"> <li>• No remarkable damage</li> <li>• Capacitance change:<br/>C0G (NP0): within ± 7.5 % or ± 0.75 pF whichever is larger.<br/>X7R, X5R: ≥ 10 V within ± 12.5 %; 6.3 V, with ± 25 %<br/>Y5V: ≥ 10 V within ± 30 %; 6.3 V, within + 30 %/- 40 %</li> <li>• Q/DF value: C0G (NP0)<br/>Cap ≥ 30 pF: Q ≥ 200;<br/>Cap &lt; 30 pF: Q ≥ 100 + 10/3 C</li> </ul> |  |                          |   |
|  |   | <b>X5R, X7R:</b>  |  |                          |   |
|  |   | <b>RATED VOLTAGE</b>  | <b>DF ≤</b>  | <b>EXCEPTION OF DF ≤</b> |   |
|  |   | ≥ 50 V  | 3 %  | 6 %                      | 0201 (50 V); 0603 ≥ 0.047 μF; 0805 ≥ 0.18 μF; 1206 ≥ 0.47 μF                                |
|  |   |   |  | 10 %                     | 1210 ≥ 4.7 μF   |
|  |   |   |  | 20 %                     | 0603 ≥ 1 μF; 0805 ≥ 1 μF; 1206 ≥ 2.2 μF; 1210 ≥ 10 μF                                       |
|  |   | 35 V  | 5 %  | 20 %                     | 0805 ≥ 2.2 μF; 1210 ≥ 10 μF   |
|  |   | 25 V  | 5 %  | 10 %                     | 0201 ≥ 0.01 μF; 0805 ≥ 1 μF; 1210 ≥ 10 μF   |
|  |   |   |  | 14 %                     | 0603 ≥ 0.33 μF; 1206 ≥ 4.7 μF   |
|  |   |   |  | 15 %                     | 0402 ≥ 0.10 μF; 0603 ≥ 0.47 μF; 0805 ≥ 2.2 μF; 1206 ≥ 6.8 μF; 1210 ≥ 22 μF                  |
|  |   | 16 V  | 5 %  | 10 %                     | 0603 ≥ 0.15 μF; 0805 ≥ 0.68 μF; 1206 ≥ 2.2 μF; 1210 ≥ 4.7 μF                                |
|  |   |   |  | 15 %                     | 0201 ≥ 0.01 μF; 0402 ≥ 0.033 μF; 0603 ≥ 0.68 μF; 0805 ≥ 2.2 μF; 1206 ≥ 4.7 μF; 1210 ≥ 22 μF |
|  |   | 10 V  | 7.5 %  | 15 %                     | 0201 ≥ 0.012 μF; 0402 ≥ 0.33 μF; 0603 ≥ 0.33 μF; 0805 ≥ 2.2 μF; 1206 ≥ 2.2 μF; 1210 ≥ 22 μF |
|  |   |   |  | 20 %                     | 0201 ≥ 0.1 μF; 0402 ≥ 1 μF  |
|  |   | 6.3 V   | 15 %   | 30 %                     | 0201 ≥ 0.1 μF; 0402 ≥ 1 μF; 0603 ≥ 10 μF; 0805 ≥ 4.7 μF; 1206 ≥ 47 μF; 1210 ≥ 100 μF        |
|  |   | 4 V   | 20 %   | -                        | -   |
|  |   | <b>Y5V:</b>   |  |                          |   |
|  |   | <b>RATED VOLTAGE</b>  | <b>DF ≤</b>  | <b>EXCEPTION OF DF ≤</b> |   |
|  |   | ≥ 50 V  | 7.5 %  | 10 %                     | 0603 ≥ 0.1 μF; 0805 ≥ 0.47 μF; 1206 ≥ 4.7 μF  |
|  |   | 35 V  | 10 %   | -                        | -   |
|  |   | 25 V  | 7.5 %  | 10 %                     | 0402 ≥ 0.047 μF; 0603 ≥ 0.1 μF; 0805 ≥ 0.33 μF; 1206 ≥ 1 μF; 1210 ≥ 4.7 μF                  |
|  |   |   |  | 15 %                     | 0402 ≥ 0.068 μF; 0603 ≥ 0.47 μF; 1206 ≥ 4.7 μF; 1210 ≥ 22 μF                                |
|  |   | 16 V<br>C < 1.0 μF  | 10 %   | 12.5 %                   | 0402 ≥ 0.068 μF; 0603 ≥ 0.68 μF   |
|  |   |   |  | 20 %                     | 0402 ≥ 0.22 μF  |
| 16 V<br>C ≥ 1.0 μF   | 12.5 %  | 20 %  | 0603 ≥ 2.2 μF; 0805 ≥ 3.3 μF; 1206 ≥ 10 μF; 1210 ≥ 22 μF |                          |   |
| 10 V   | 20 %  | 30 %  | 0402 ≥ 0.47 μF   |                          |   |
| 6.3 V  | 30 %  | -   | -  |                          |   |
| <ul style="list-style-type: none"> <li>• I.R.: ≥ 10 V: 500 MΩ or 25 ΩF whichever is smaller</li> </ul> |   |   |  |                          |   |
| <b>CLASS 2 (X5R, X7R, Y5V):</b>  |   |   |  |                          |   |
| <b>RATED VOLTAGE</b>   |   |   | <b>INSULATION RESISTANCE</b>                             |                          |   |
| 100 V: X7R   |   |   | 500 MΩ or<br>R x C ≥ 5 ΩF<br>whichever is less           |                          |   |
| 50 V: 0603 ≥ 1 μF; 0805 ≥ 1 μF; 1206 ≥ 2.2 μF; 1210 ≥ 4.7 μF   |   |   |  |                          |   |
| 35 V: 0805 ≥ 2.2 μF; 1210 ≥ 10 μF  |   |   |  |                          |   |
| 25 V: 0402 ≥ 1 μF; 0603 ≥ 2.2 μF; 0805 ≥ 2.2 μF; 1206 ≥ 10 μF; 1210 ≥ 10 μF                            |   |   |  |                          |   |
| 16 V: 0402 ≥ 0.22 μF; 0603 ≥ 1 μF; 0805 ≥ 2.2 μF; 1206 ≥ 10 μF; 1210 ≥ 47 μF                           |   |   |  |                          |   |
| 10 V: 0201 ≥ 47 nF; 0402 ≥ 0.47 μF; 0603 ≥ 0.47 μF; 0805 ≥ 2.2 μF; 1206 ≥ 4.7 μF; 1210 ≥ 47 μF         |   |   |  |                          |   |
| 6.3 V; 4 V   |   |   |  |                          |   |



| VJ...W1BC TEST PROCEDURES AND REQUIREMENTS  |   |                   |   |  |                      |  |  |   |  |
|---|---|-------------------|---|--|----------------------|--|--|---|--|
| TEST  | PROCEDURE   |                   |   | REQUIREMENTS   |                      |  |  |   |  |
| 15) High temp. load (endurance)   | <ul style="list-style-type: none"> <li>Test temperature:<br/>COG (NP0), X7R/X7E: 125 °C ± 3 °C<br/>X5R, Y5V: 85 °C ± 3 °C</li> <li>To apply voltage:</li> </ul> |                   |   | <ul style="list-style-type: none"> <li>No remarkable damage</li> <li>Capacitance change:<br/>COG (NP0): ± 3.0 % or ± 0.3 pF whichever is larger.<br/>X7R, X5R: ≥ 10 V within ± 12.5 %; 6.3 V, with ± 25 %<br/>Y5V: ≥ 10 V within ± 30 %; 6.3 V, within + 30 % to - 40 %</li> <li>Q/DF value:<br/>COG (NP0): More than 30 pF, Q ≥ 350<br/>10 pF ≤ C &lt; 30 pF: Q ≥ 275 C + 2.5 C;<br/>Less than 10 pF: Q ≥ 200 C + 10 C</li> </ul> |                      |  |  |   |  |
|   | (1.1) 100 % of rated voltage for below range  |                   |   | <b>X5R, X7R:</b>   |                      |  |  |   |  |
|   | <b>SIZE</b>   | <b>DIELECTRIC</b> | <b>RATED VOLTAGE</b>  | <b>CAP. RANGE</b>  | <b>RATED VOLTAGE</b> | <b>DF ≤</b>  | <b>EXCEPTION OF DF ≤</b>   |   |  |
|   | 0201  | X5R/X7R           | 6.3 V, 10 V   | C ≥ 0.1 μF   | ≥ 50 V               | 3 %  | 6 %  | 0201 (50 V); 0603 ≥ 0.047 μF; 0805 ≥ 0.18 μF; 1206 ≥ 0.47 μF                                |  |
|   | 0402  | X5R/X7R           | 6.3 V, 10 V   | C ≥ 1 μF   |                      |  | 10 %   | 1210 ≥ 4.7 μF   |  |
|   | 0603  | X5R/X7R           | 6.3 V, 10 V   | C ≥ 4.7 μF   |                      |  | 20 %   | 0603 ≥ 1 μF; 0805 ≥ 1 μF; 1206 ≥ 2.2 μF; 1210 ≥ 10 μF                                       |  |
|   | 0805  | X5R/X7R           | 6.3 V   | C ≥ 22 μF  | 35 V                 | 5 %  | 20 %   | 0805 ≥ 2.2 μF; 1210 ≥ 10 μF   |  |
|   | 1206  | X5R/X7R           | 6.3 V   | C ≥ 47 μF  | 25 V                 | 5 %  | 10 %   | 0201 ≥ 0.01 μF; 0805 ≥ 1 μF; 1210 ≥ 10 μF   |  |
|   | (1.2) 6.3 V or C ≥ 10 μF: 150 % of rated voltage  |                   |   | 14 %   |                      |  | 0603 ≥ 0.33 μF; 1206 ≥ 4.7 μF  |   |  |
|   | (2) 10 V ≤ U <sub>R</sub> < 500 V: 200 % of rated voltage   |                   |   | 15 %   |                      |  | 0402 ≥ 0.10 μF; 0603 ≥ 0.47 μF; 0805 ≥ 2.2 μF; 1206 ≥ 6.8 μF; 1210 ≥ 22 μF |   |  |
|   | 150 % of rated voltage for below range:   |                   |   | 16 V   | 5 %                  | 10 %   | 0603 ≥ 0.15 μF; 0805 ≥ 0.68 μF; 1206 ≥ 2.2 μF; 1210 ≥ 4.7 μF               |   |  |
|   | <b>SIZE</b>   | <b>DIELECTRIC</b> | <b>RATED VOLTAGE</b>  |  |                      | <b>CAP. RANGE</b>  | 15 %   | 0201 ≥ 0.01 μF; 0402 ≥ 0.033 μF; 0603 ≥ 0.68 μF; 0805 ≥ 2.2 μF; 1206 ≥ 4.7 μF; 1210 ≥ 22 μF |  |
|   | 0402  | X5R/X7R           | 10 V, 16 V, 25 V  |  |                      | C ≥ 0.22 μF  | 10 V   | 7.5 %   | 15 %   |
|   |   | Y5V               | 16 V  | C ≥ 0.47 μF  | 20 %                 | 0201 ≥ 0.1 μF; 0402 ≥ 1 μF   |  |   |  |
|   |   | 0603              | X5R/X7R   | 10 V, 16 V   | C ≥ 1.0 μF           | 6.3 V  | 15 %   | 30 %  | 0201 ≥ 0.1 μF; 0402 ≥ 1 μF; 0603 ≥ 10 μF; 0805 ≥ 4.7 μF; 1206 ≥ 47 μF; 1210 ≥ 100 μF |
|   |   |                   | Y5V   | 16 V   | C ≥ 2.2 μF           | 4 V  | 20 %   | -   | -  |
|   |   | 0805              | X5R/X7R   | 10 V   | C ≥ 4.7 μF           | <b>Y5V:</b>  |  |   |  |
|   |   |                   | Y5V   | 16 V   | C ≥ 4.7 μF           | <b>RATED VOLTAGE</b>   | <b>DF ≤</b>  | <b>EXCEPTION OF DF ≤</b>  |  |
|   | (3) 500 V: 150 % of rated voltage   |                   |   | ≥ 50 V   | 7.5 %                | 10 %   | 0603 ≥ 0.1 μF; 0805 ≥ 0.47 μF; 1206 ≥ 4.7 μF                               |   |  |
|   | (4) U <sub>R</sub> ≥ 630 V: 120 % of rated voltage  |                   |   | 35 V   | 10 %                 | -  | -  |   |  |
| <ul style="list-style-type: none"> <li>Test time: 1000 h + 24 h/- 0 h</li> <li>Before measurement (class 2 only): Perform 150 °C + 0 °C/- 10 °C for 1 h and then set for 24 h ± 2 h at room temperature</li> <li>Measurement to be made after keeping at room temperature for 24 h ± 2 h</li> </ul> |   |                   | 25 V  | 7.5 %  | 10 %                 | 0402 ≥ 0.047 μF; 0603 ≥ 0.1 μF; 0805 ≥ 0.33 μF; 1206 ≥ 1 μF; 1210 ≥ 4.7 μF |  |   |  |
|   |   |                   |   |  | 15 %                 | 0402 ≥ 0.068 μF; 0603 ≥ 0.47 μF; 1206 ≥ 4.7 μF; 1210 ≥ 22 μF               |  |   |  |
|   |   |                   |   |  | 12.5 %               | 0402 ≥ 0.068 μF; 0603 ≥ 0.68 μF  |  |   |  |
|   |   |                   | 16 V<br>C < 1.0 μF  | 10 %   | 20 %                 | 0603 ≥ 2.2 μF; 0805 ≥ 3.3 μF; 1206 ≥ 10 μF; 1210 ≥ 22 μF                   |  |   |  |
|   |   |                   | 16 V<br>C ≥ 1.0 μF  | 12.5 %   | 20 %                 | 0603 ≥ 2.2 μF; 0805 ≥ 3.3 μF; 1206 ≥ 10 μF; 1210 ≥ 22 μF                   |  |   |  |
|   |   |                   | 10 V  | 20 %   | 30 %                 | 0402 ≥ 0.47 μF   |  |   |  |
|   |   |                   | 6.3 V   | 30 %   | -                    | -  |  |   |  |
|   |   |                   | <ul style="list-style-type: none"> <li>I. R.: ≥ 10 V: 1 GΩ or 50 ΩF whichever is smaller</li> </ul> |  |                      |  |  |   |  |
|   |   |                   | <b>CLASS 2 (X5R, X7R, Y5V):</b>   |  |                      |  |  |   |  |
|   |   |                   | <b>RATED VOLTAGE</b>  |  |                      |  | <b>INSULATION RESISTANCE</b>   |   |  |
|   |   |                   | 100 V: X7R  |  |                      |  | 1 GΩ or<br>R x C ≥ 10 ΩF<br>whichever is less                              |   |  |
|   |   |                   | 50 V: 0603 ≥ 1 μF; 0805 ≥ 1 μF; 1206 ≥ 2.2 μF; 1210 ≥ 4.7 μF  |  |                      |  |  |   |  |
|   |   |                   | 35 V: 0805 ≥ 2.2 μF; 1210 ≥ 10 μF   |  |                      |  |  |   |  |
|   |   |                   | 25 V: 0402 ≥ 1 μF; 0603 ≥ 2.2 μF; 0805 ≥ 2.2 μF; 1206 ≥ 10 μF; 1210 ≥ 10 μF                         |  |                      |  |  |   |  |
|   |   |                   | 16 V: 0402 ≥ 0.22 μF; 0603 ≥ 1 μF; 0805 ≥ 2.2 μF; 1206 ≥ 10 μF; 1210 ≥ 47 μF                        |  |                      |  |  |   |  |
|   |   |                   | 10 V: 0201 ≥ 47 nF; 0402 ≥ 0.47 μF; 0603 ≥ 0.47 μF; 0805 ≥ 2.2 μF; 1206 ≥ 4.7 μF; 1210 ≥ 47 μF      |  |                      |  |  |   |  |
|   |   |                   | 6.3 V; 4 V  |  |                      |  |  |   |  |

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