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## **EYANG TECHNOLOGY DEVELOPMENT CO.,LTD**

### **Multilayer Ceramic Chip Capacitors for Automotive Powertrain & Safety Model selection reference book**

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Mark: The Model selection reference book is for design reference only.

**Multilayer Ceramic Chip Capacitors for Automotive Powertrain & Safety****1.Scope**

This specification is applicable to the Multilayer Ceramic Chip Capacitors (MLCC) for Automotive Powertrain & Safety.

**1.1 Temperature Characteristics:**

Class1 (Temperature Compensating Type): C0G/X8G

Class2 (High dielectric constant type): X8R\X8L\X7R\X7S\X7T

**1.2 Size Code:** 0201\0402\0603\0805\1206\1210

**1.3 Capacitance :** 0.1pF~220μF

**2.Part Number System**

| E             | 0402        | C0G                           | 120                   | J                       | 500             | N                  | I                | B                |
|---------------|-------------|-------------------------------|-----------------------|-------------------------|-----------------|--------------------|------------------|------------------|
| ① Series Code | ② Size Code | ③ Temperature Characteristics | ④ Nominal Capacitance | ⑤ Capacitance Tolerance | ⑥ Rated Voltage | ⑦ Termination Type | ⑧ Packaging Code | ⑨ Thickness Code |

① **Series Code** E-Multilayer Ceramic Chip Capacitors for Automotive Powertrain & Safety

② **Size Code** (Unit:mm)

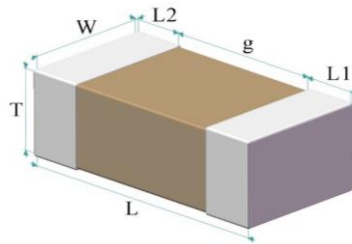


Fig.1 Structure & Dimension

| Size Code | L               | W               | L1,L2     | g         | T               | Thickness Code |
|-----------|-----------------|-----------------|-----------|-----------|-----------------|----------------|
| 0201      | 0.60±0.03       | 0.30±0.03       | 0.10~0.20 | 0.20min.  | 0.30±0.03       | A              |
| 0201      | 0.60±0.09       | 0.30±0.09       | 0.10~0.20 | 0.20min.  | 0.30±0.09       | F              |
| 0402      | 1.00±0.05       | 0.50±0.05       | 0.15~0.35 | 0.30min.  | 0.50±0.05       | B              |
| 0402      | 1.00+0.15/-0.05 | 0.50+0.15/-0.05 | 0.15~0.35 | 0.30min.  | 0.50+0.15/-0.05 | N              |
| 0402      | 1.00+0.20/-0.05 | 0.50+0.20/-0.05 | 0.15~0.35 | 0.30min.  | 0.50+0.20/-0.05 | C              |
| 0603      | 1.60±0.10       | 0.80±0.10       | 0.20~0.50 | 0.50min.  | 0.80±0.10       | D              |
| 0603      | 1.60+0.20/-0.10 | 0.80+0.20/-0.10 | 0.20~0.50 | 0.50min.  | 0.80+0.20/-0.10 | K              |
| 0805      | 2.00±0.10       | 1.25±0.10       | 0.20~0.70 | 0.70min.  | 0.60±0.10       | C              |
| 0805      | 2.00±0.20       | 1.25±0.20       | 0.20~0.70 | 0.70min.  | 0.85±0.15       | K              |
| 0805      | 2.00±0.20       | 1.25±0.20       | 0.20~0.70 | 0.70min.  | 0.85+0.15/-0.35 | Y              |
| 0805      | 2.00±0.10       | 1.25±0.10       | 0.20~0.70 | 0.70min.  | 1.25±0.10       | G              |
| 0805      | 2.00±0.20       | 1.25±0.20       | 0.20~0.70 | 0.70min.  | 1.25±0.20       | H              |
| 1206      | 3.20±0.15       | 1.60±0.15       | 0.30~0.80 | 1.50 min. | 0.85±0.10       | E              |
| 1206      | 3.20±0.20       | 1.60±0.20       | 0.30~0.80 | 1.50 min. | 1.15±0.15       | O              |
| 1206      | 3.20±0.20       | 1.60±0.20       | 0.30~0.80 | 1.50 min. | 1.60±0.20       | L              |
| 1206      | 3.20±0.30       | 1.60±0.30       | 0.30~0.80 | 1.50 min. | 1.60±0.30       | P              |
| 1210      | 3.20±0.20       | 2.50±0.20       | 0.30~0.90 | 1.50 min. | 1.60±0.20       | L              |
| 1210      | 3.20±0.20       | 2.50±0.20       | 0.30~0.90 | 1.50 min. | 2.00±0.20       | Q              |
| 1210      | 3.20±0.30       | 2.50±0.20       | 0.30~0.90 | 1.50 min. | 2.50±0.20       | R              |
| 1210      | 3.20±0.40       | 2.50±0.30       | 0.30~0.90 | 1.50 min. | 2.50±0.30       | 3              |

## ③ Temperature Characteristics

| Temperature Characteristics | Operating Temp. Range | Temperature Characteristics |              |            |
|-----------------------------|-----------------------|-----------------------------|--------------|------------|
|                             |                       | Temp. coeff. or Cap. Change | Temp. Range  | Ref. Temp. |
| C0G                         | -55°C~ 125°C          | 0±30ppm/°C                  | 25°C~125°C   | 25°C       |
| X8G                         | -55°C~150°C           | 0±30ppm/°C                  | 25°C~125°C   | 25°C       |
| X8R                         | -55°C~ 150°C          | ±15%                        | -55°C~ 150°C | 25°C       |
| X8L                         | -55°C~ 150°C          | +15%/-40%                   | -55°C~ 150°C | 25°C       |
| X7R                         | -55°C~125°C           | ±15%                        | -55°C~125°C  | 25°C       |
| X7S                         | -55°C ~ 125°C         | ±22%                        | -55°C~125°C  | 25°C       |
| X7T                         | -55°C~125°C           | +22%/-33%                   | -55°C~125°C  | 25°C       |

④ Nominal Capacitance (Unit: pF)  $1\text{pF}=10^{-3}\text{nF}=10^{-6}\mu\text{F}$ 

Example :R47=0.47 pF ,2R2=2.2 pF ,120=12×10<sup>0</sup>=12pF, 104=10×10<sup>4</sup>=100000 pF=100 nF,

Class1(C0G\X8G) Capacitance Step in E24 series. Capacitance: See Table3-1

Class2(X8R\X8L\X7R\X7S\X7T) Capacitance Step in E12 series,Capacitance: See Table3-2

## ⑤ Capacitance Tolerance

| Code | Capacitance Tolerance | Code | Capacitance Tolerance |
|------|-----------------------|------|-----------------------|
| A    | ±0.05 pF              | G    | ±2%                   |
| B    | ±0.1pF                | J    | ±5%                   |
| C    | ±0.25pF               | K    | ±10%                  |
| D    | ±0.5pF                | L    | ±15%                  |
| F    | ±1%                   | M    | ±20%                  |

## ⑥ Rated Voltage

| Code | Voltage Values | Code | Voltage Values |
|------|----------------|------|----------------|
| 2R5  | 2.5V           | 800  | 80V            |
| 4R0  | 4.0V           | 101  | 100V           |
| 6R3  | 6.3V           | 201  | 200V           |
| 100  | 10V            | 251  | 250V           |
| 160  | 16V            | 501  | 500V           |
| 250  | 25V            | 631  | 630V           |
| 350  | 35V            | 102  | 1000V          |
| 500  | 50V            | 202  | 2000V          |

## ⑦ Termination Type

| Code | Terminal Electrodes | Plating Material |
|------|---------------------|------------------|
| N    | Cu                  | Ni/Sn            |

## ⑧ Packaging Code See Table 4.

## ⑨ Thickness Code See ② Size Code

Table 3-1 Capacitance Table ( Class1-C0G\X8G)

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage | Capacitance | Thickness code |
|-----|-------------|-----------------------------|-----------|---------------|-------------|----------------|
| 1   | E           | C0G                         | 0201      | 50V           | A           | 0.1pF~100pF    |
| 2   | E           | C0G                         | 0201      | 25V           | A           | 0.1pF~100pF    |
| 3   | E           | C0G                         | 0402      | 50V           | B           | 0.1pF~1nF      |
| 4   | E           | C0G                         | 0402      | 25V           | B           | 0.1pF~1nF      |
| 5   | E           | C0G                         | 0603      | 100V          | D           | 0.5pF~6.8nF    |
| 6   | E           | C0G                         | 0603      | 50V           | D           | 0.5pF~10nF     |
| 7   | E           | C0G                         | 0603      | 25V           | D           | 0.5pF~10nF     |
| 8   | E           | C0G                         | 0805      | 630V          | K           | 10pF~560pF     |
| 9   | E           | C0G                         | 0805      | 630V          | H           | 680pF~2.2nF    |
| 10  | E           | C0G                         | 0805      | 250V          | K           | 10pF~3.9nF     |
| 11  | E           | C0G                         | 0805      | 250V          | H           | 4.7nF~10nF     |
| 12  | E           | C0G                         | 0805      | 100V          | C           | 10pF~3.9nF     |
| 13  | E           | C0G                         | 0805      | 100V          | K           | 4.7nF~15nF     |
| 14  | E           | C0G                         | 0805      | 100V          | G           | 18nF~22nF      |
| 15  | E           | C0G                         | 0805      | 80V           | C           | 10pF~3.9nF     |
| 16  | E           | C0G                         | 0805      | 80V           | K           | 4.7nF~15nF     |
| 17  | E           | C0G                         | 0805      | 80V           | G           | 18nF~22nF      |
| 18  | E           | C0G                         | 0805      | 50V           | C           | 10pF~3.9nF     |
| 19  | E           | C0G                         | 0805      | 50V           | K           | 4.7nF~15nF     |
| 20  | E           | C0G                         | 0805      | 50V           | G           | 18nF~22nF      |
| 21  | E           | C0G                         | 1206      | 1000V         | E           | 10pF~470pF     |
| 22  | E           | C0G                         | 1206      | 1000V         | O           | 10pF~750pF     |
| 23  | E           | C0G                         | 1206      | 1000V         | L           | 820pF~1.0nF    |
| 24  | E           | C0G                         | 1206      | 630V          | E           | 10pF~1.8nF     |
| 25  | E           | C0G                         | 1206      | 630V          | O           | 2.2nF~3.3nF    |
| 26  | E           | C0G                         | 1206      | 630V          | L           | 3.6nF~10nF     |
| 27  | E           | C0G                         | 1206      | 250V          | O           | 6.8nF~12nF     |
| 28  | E           | C0G                         | 1206      | 250V          | L           | 15nF~22nF      |
| 29  | E           | C0G                         | 1206      | 100V          | E           | 10pF~39nF      |
| 30  | E           | C0G                         | 1206      | 100V          | O           | 47nF           |
| 31  | E           | C0G                         | 1206      | 100V          | L           | 56nF~100nF     |
| 32  | E           | C0G                         | 1206      | 50V           | E           | 10pF~39nF      |

Table 3-1 Capacitance Table ( Class1-C0G\X8G)

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage | Capacitance | Thickness code |
|-----|-------------|-----------------------------|-----------|---------------|-------------|----------------|
| 33  | E           | C0G                         | 1206      | 50V           | O           | 47nF           |
| 34  | E           | C0G                         | 1206      | 50V           | L           | 56nF~100nF     |
| 35  | E           | C0G                         | 1210      | 1000V         | Q           | 1.0nF~8.2nF    |
| 36  | E           | C0G                         | 1210      | 1000V         | R           | 10nF~22nF      |
| 37  | E           | C0G                         | 1210      | 630V          | Q           | 6.8nF~18nF     |
| 38  | E           | C0G                         | 1210      | 630V          | R           | 22nF~27nF      |
| 39  | E           | C0G                         | 1210      | 630V          | 3           | 33nF           |
| 40  | E           | X8G                         | 0402      | 50V           | B           | 0.1pF~1nF      |
| 41  | E           | X8G                         | 0603      | 100V          | D           | 10pF~1nF       |
| 42  | E           | X8G                         | 0603      | 50V           | D           | 1pF~2.7nF      |
| 43  | E           | X8G                         | 0805      | 100V          | C           | 100pF~1nF      |
| 44  | E           | X8G                         | 0805      | 100V          | K           | 1.2nF~1.5nF    |
| 45  | E           | X8G                         | 0805      | 50V           | C           | 100pF~3.9nF    |
| 46  | E           | X8G                         | 0805      | 50V           | K           | 4.7nF~10nF     |
| 47  | E           | X8G                         | 1206      | 100V          | E           | 1nF~5.6nF      |
| 48  | E           | X8G                         | 1206      | 50V           | E           | 1nF~22nF       |

Table 3-2 Capacitance Table ( Class 2-X8R\X8L\X7R\X7S\X7T)

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage | Thickness code | Capacitance |
|-----|-------------|-----------------------------|-----------|---------------|----------------|-------------|
| 1   | E           | X7R                         | 0201      | 25V           | A              | 100pF~3.3nF |
| 2   | E           | X7R                         | 0201      | 16V           | A              | 330pF~4.7nF |
| 3   | E           | X7R                         | 0201      | 10V           | A              | 1.2nF~10nF  |
| 4   | E           | X7R                         | 0402      | 100V          | B              | 220pF~4.7nF |
| 5   | E           | X7R                         | 0402      | 50V           | B              | 220pF~22nF  |
| 6   | E           | X7R                         | 0402      | 50V           | B              | 33nF~100nF  |
| 7   | E           | X7R                         | 0402      | 25V           | B              | 4.7nF~27nF  |
| 8   | E           | X7R                         | 0402      | 25V           | B              | 33nF~47nF   |
| 9   | E           | X7R                         | 0402      | 25V           | B              | 100nF       |
| 10  | E           | X7R                         | 0402      | 16V           | B              | 220pF~22nF  |
| 11  | E           | X7R                         | 0402      | 16V           | B              | 27nF~100nF  |
| 12  | E           | X7R                         | 0402      | 16V           | B              | 120nF~220nF |
| 13  | E           | X7R                         | 0402      | 10V           | B              | 100nF       |
| 14  | E           | X7R                         | 0402      | 10V           | B              | 120nF~220nF |
| 15  | E           | X7R                         | 0603      | 100V          | D              | 150pF~47nF  |
| 16  | E           | X7R                         | 0603      | 50V           | D              | 150pF~100nF |
| 17  | E           | X7R                         | 0603      | 50V           | D              | 120nF~220nF |
| 18  | E           | X7R                         | 0603      | 25V           | D              | 150pF~100nF |
| 19  | E           | X7R                         | 0603      | 25V           | D              | 120nF~330nF |
| 20  | E           | X7R                         | 0603      | 25V           | D              | 470nF~1μF   |
| 21  | E           | X7R                         | 0603      | 16V           | D              | 150pF~100nF |
| 22  | E           | X7R                         | 0603      | 16V           | D              | 120nF~470nF |
| 23  | E           | X7R                         | 0603      | 16V           | D              | 680nF~1μF   |
| 24  | E           | X7R                         | 0603      | 6.3V          | D              | 2.2μF       |
| 25  | E           | X7R                         | 0805      | 250V          | Y              | 10nF        |
| 26  | E           | X7R                         | 0805      | 100V          | Y              | 1nF~100nF   |
| 27  | E           | X7R                         | 0805      | 50V           | Y              | 1nF~100nF   |
| 28  | E           | X7R                         | 0805      | 50V           | H              | 220nF~470nF |
| 29  | E           | X7R                         | 0805      | 50V           | H              | 680nF~1μF   |
| 30  | E           | X7R                         | 0805      | 25V           | Y              | 1nF~100nF   |
| 31  | E           | X7R                         | 0805      | 25V           | H              | 220nF~1μF   |
| 32  | E           | X7R                         | 0805      | 25V           | H              | 2.2μF       |

Table 3-2 Capacitance Table ( Class 2-X8R\X8L\X7R\X7S\X7T)

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage | Thickness code | Capacitance             |
|-----|-------------|-----------------------------|-----------|---------------|----------------|-------------------------|
| 33  | E           | X7R                         | 0805      | 16V           | H              | 1 $\mu$ F               |
| 34  | E           | X7R                         | 0805      | 16V           | H              | 2.2 $\mu$ F             |
| 35  | E           | X7R                         | 0805      | 16V           | H              | 3.3 $\mu$ F             |
| 36  | E           | X7R                         | 0805      | 16V           | H              | 4.7 $\mu$ F             |
| 37  | E           | X7R                         | 0805      | 10V           | H              | 1 $\mu$ F               |
| 38  | E           | X7R                         | 0805      | 10V           | H              | 2.2 $\mu$ F             |
| 39  | E           | X7R                         | 0805      | 10V           | H              | 3.3 $\mu$ F             |
| 40  | E           | X7R                         | 0805      | 10V           | H              | 4.7 $\mu$ F             |
| 41  | E           | X7R                         | 0805      | 10V           | H              | 10 $\mu$ F              |
| 42  | E           | X7R                         | 0805      | 6.3V          | H              | 10 $\mu$ F              |
| 43  | E           | X7R                         | 1206      | 630V          | O              | 1nF~10nF                |
| 44  | E           | X7R                         | 1206      | 630V          | L              | 33nF                    |
| 45  | E           | X7R                         | 1206      | 100V          | O              | 100nF~220nF             |
| 46  | E           | X7R                         | 1206      | 100V          | L              | 100nF~470nF             |
| 47  | E           | X7R                         | 1206      | 100V          | L              | 1 $\mu$ F               |
| 48  | E           | X7R                         | 1206      | 50V           | L              | 1.5 $\mu$ F             |
| 49  | E           | X7R                         | 1206      | 50V           | L              | 2.2 $\mu$ F             |
| 50  | E           | X7R                         | 1206      | 25V           | L              | 1.0 $\mu$ F~4.7 $\mu$ F |
| 51  | E           | X7R                         | 1206      | 16V           | L              | 1.0 $\mu$ F~4.7 $\mu$ F |
| 52  | E           | X7R                         | 1206      | 16V           | L              | 10 $\mu$ F              |
| 53  | E           | X7R                         | 1206      | 10V           | L              | 10 $\mu$ F              |
| 54  | E           | X7R                         | 1206      | 10V           | L              | 22 $\mu$ F              |
| 55  | E           | X7R                         | 1206      | 6.3V          | L              | 22 $\mu$ F              |
| 56  | E           | X7R                         | 1210      | 50V           | R              | 3.3 $\mu$ F~4.7 $\mu$ F |
| 57  | E           | X7R                         | 1210      | 25V           | R              | 3.3 $\mu$ F~4.7 $\mu$ F |
| 58  | E           | X7R                         | 1210      | 25V           | R              | 10 $\mu$ F              |
| 59  | E           | X7R                         | 1210      | 25V           | 3              | 22 $\mu$ F              |
| 60  | E           | X7R                         | 1210      | 16V           | R              | 10 $\mu$ F              |
| 61  | E           | X7R                         | 1210      | 16V           | R              | 22 $\mu$ F              |
| 62  | E           | X7R                         | 1210      | 10V           | R              | 22 $\mu$ F              |
| 63  | E           | X7R                         | 1210      | 6.3V          | R              | 47 $\mu$ F              |
| 64  | E           | X7S                         | 0201      | 10V           | A              | 100nF                   |

Table 3-2 Capacitance Table ( Class 2-X8R\X8L\X7R\X7S\X7T)

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage | Thickness code | Capacitance |
|-----|-------------|-----------------------------|-----------|---------------|----------------|-------------|
| 65  | E           | X7S                         | 0201      | 6.3V          | A              | 100nF       |
| 66  | E           | X7S                         | 0201      | 4.0V          | A              | 100nF       |
| 67  | E           | X7S                         | 0402      | 10V           | N              | 470nF       |
| 68  | E           | X7S                         | 0402      | 10V           | C              | 680nF~1μF   |
| 69  | E           | X7S                         | 0603      | 16V           | K              | 2.2μF       |
| 70  | E           | X7S                         | 0603      | 10V           | D              | 2.2μF       |
| 71  | E           | X7S                         | 0603      | 6.3V          | D              | 2.2μF       |
| 72  | E           | X7S                         | 0805      | 25V           | H              | 4.7μF       |
| 73  | E           | X7S                         | 0805      | 25V           | H              | 10μF        |
| 74  | E           | X7S                         | 0805      | 16V           | H              | 10μF        |
| 75  | E           | X7S                         | 0805      | 10V           | G              | 4.7μF       |
| 76  | E           | X7S                         | 1206      | 100V          | L              | 2.2μF       |
| 77  | E           | X7S                         | 1206      | 50V           | L              | 2.2μF       |
| 78  | E           | X7S                         | 1206      | 25V           | P              | 10μF        |
| 79  | E           | X7S                         | 1206      | 16V           | P              | 10μF        |
| 80  | E           | X7S                         | 1206      | 16V           | P              | 22μF        |
| 81  | E           | X7S                         | 1210      | 50V           | R              | 10μF        |
| 82  | E           | X7S                         | 1210      | 25V           | R              | 10μF        |
| 83  | E           | X7S                         | 1210      | 25V           | 3              | 22μF        |
| 84  | E           | X7S                         | 1210      | 10V           | R              | 47μF        |
| 85  | E           | X7T                         | 0201      | 2.5V          | F              | 1μF         |
| 86  | E           | X7T                         | 0402      | 4V            | C              | 4.7μF       |
| 87  | E           | X7T                         | 0402      | 2.5V          | C              | 10μF        |
| 88  | E           | X7T                         | 0603      | 6.3V          | K              | 4.7μF       |
| 89  | E           | X7T                         | 0603      | 6.3V          | K              | 10μF        |
| 90  | E           | X7T                         | 0603      | 4V            | K              | 10μF        |
| 91  | E           | X7T                         | 0805      | 50V           | H              | 2.2μF       |
| 92  | E           | X7T                         | 0805      | 16V           | H              | 10μF        |
| 93  | E           | X7T                         | 0805      | 10V           | H              | 10μF        |
| 94  | E           | X7T                         | 0805      | 6.3V          | H              | 10μF        |
| 95  | E           | X7T                         | 0805      | 6.3V          | H              | 22μF        |
| 96  | E           | X7T                         | 0805      | 4V            | H              | 22μF        |

Table 3-2 Capacitance Table ( Class 2-X8R\X8L\X7R\X7S\X7T)

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage | Thickness code | Capacitance |
|-----|-------------|-----------------------------|-----------|---------------|----------------|-------------|
| 97  | E           | X7T                         | 1206      | 50V           | P              | 10μF        |
| 98  | E           | X7T                         | 1206      | 6.3V          | L              | 22μF        |
| 99  | E           | X7T                         | 1206      | 4V            | L              | 47μF        |
| 100 | E           | X7T                         | 1210      | 6.3V          | R              | 22μF        |
| 101 | E           | X7T                         | 1210      | 6.3V          | R              | 47μF        |
| 102 | E           | X7T                         | 1210      | 2.5V          | 3              | 220μF       |
| 103 | E           | X7T                         | 1210      | 2.5V          | 3              | 100μF       |
| 104 | E           | X8R                         | 0402      | 50V           | B              | 220pF~1nF   |
| 105 | E           | X8R                         | 0603      | 100V          | D              | 1nF~10nF    |
| 106 | E           | X8R                         | 0603      | 50V           | D              | 1nF~6.8nF   |
| 107 | E           | X8R                         | 0603      | 50V           | D              | 10nF~47nF   |
| 108 | E           | X8R                         | 0603      | 25V           | D              | 68nF~100nF  |
| 109 | E           | X8R                         | 0805      | 100V          | K              | 10nF~33nF   |
| 110 | E           | X8R                         | 0805      | 100V          | H              | 33nF~47nF   |
| 111 | E           | X8R                         | 0805      | 50V           | K              | 10nF~33nF   |
| 112 | E           | X8R                         | 0805      | 50V           | G              | 33nF~100nF  |
| 113 | E           | X8R                         | 0805      | 50V           | H              | 33nF~100nF  |
| 114 | E           | X8R                         | 0805      | 25V           | H              | 150nF~330nF |
| 115 | E           | X8R                         | 1206      | 100V          | O              | 68nF~100nF  |
| 116 | E           | X8R                         | 1206      | 100V          | L              | 150nF~330nF |
| 117 | E           | X8R                         | 1206      | 50V           | O              | 150nF~330nF |
| 118 | E           | X8R                         | 1206      | 50V           | L              | 470nF       |
| 119 | E           | X8R                         | 1206      | 25V           | O              | 470nF       |
| 120 | E           | X8R                         | 1206      | 25V           | L              | 680nF~1μF   |
| 121 | E           | X8L                         | 0402      | 50V           | B              | 220pF~4.7nF |
| 122 | E           | X8L                         | 0402      | 25V           | B              | 5.6nF~10nF  |
| 123 | E           | X8L                         | 0402      | 16V           | B              | 15nF~47nF   |
| 124 | E           | X8L                         | 0805      | 50V           | H              | 220nF~330nF |

Table 4 Packaging (Minimum Quantity)

| NO. | Size Code | Thickness Code | Square hole spacing | Disc Size | Carrier Tape Type | QTY (Kpcs) | Packaging Code |
|-----|-----------|----------------|---------------------|-----------|-------------------|------------|----------------|
| 1   | 0201      | A              | 2mm                 | 7 #       | Paper             | 15         | T              |
| 2   | 0201      | A              | 2mm                 | 13 #      | Paper             | 50         | J              |
| 3   | 0201      | A              | 1mm                 | 13 #      | Paper             | 100        | D              |
| 4   | 0201      | A              | 2mm                 | 7 #       | Paper             | 10         | H              |
| 5   | 0201      | A              | 1mm                 | 7 #       | Paper             | 30         | L              |
| 6   | 0201      | F              | 2mm                 | 7 #       | Paper             | 15         | T              |
| 7   | 0402      | B              | 2mm                 | 7 #       | Paper             | 10         | T              |
| 8   | 0402      | B              | 2mm                 | 13 #      | Paper             | 50         | J              |
| 9   | 0402      | N              | 2mm                 | 7 #       | Paper             | 10         | T              |
| 10  | 0402      | N              | 2mm                 | 13 #      | Paper             | 50         | J              |
| 11  | 0402      | C              | 2mm                 | 7 #       | Paper             | 10         | T              |
| 12  | 0402      | C              | 2mm                 | 13 #      | Paper             | 50         | J              |
| 13  | 0603      | D              | 4mm                 | 7 #       | Paper             | 4          | T              |
| 14  | 0603      | D              | 4mm                 | 13 #      | Paper             | 15         | A              |
| 15  | 0603      | D              | 4mm                 | 13 #      | Plastic           | 10         | O              |
| 16  | 0603      | D              | 4mm                 | 7 #       | Paper             | 3          | W              |
| 17  | 0603      | K              | 4mm                 | 7 #       | Paper             | 4          | T              |
| 18  | 0603      | K              | 4mm                 | 13 #      | Paper             | 15         | A              |
| 19  | 0603      | K              | 4mm                 | 13 #      | Plastic           | 10         | O              |
| 20  | 0603      | K              | 4mm                 | 7 #       | Paper             | 3          | W              |
| 21  | 0603      | K              | 4mm                 | 7 #       | Plastic           | 4          | Q              |
| 22  | 0603      | K              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 23  | 0805      | C              | 4mm                 | 7 #       | Paper             | 4          | T              |
| 24  | 0805      | C              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 25  | 0805      | K              | 4mm                 | 7 #       | Paper             | 4          | T              |
| 26  | 0805      | K              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 27  | 0805      | K              | 4mm                 | 13 #      | Plastic           | 15         | E              |
| 28  | 0805      | Y              | 4mm                 | 7 #       | Paper             | 4          | T              |
| 29  | 0805      | Y              | 4mm                 | 13 #      | Plastic           | 15         | E              |
| 30  | 0805      | Y              | 4mm                 | 7 #       | Plastic           | 2          | P              |
| 31  | 0805      | Y              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 32  | 0805      | G              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 33  | 0805      | G              | 4mm                 | 7 #       | Plastic           | 2          | P              |
| 34  | 0805      | G              | 4mm                 | 13 #      | Plastic           | 10         | O              |
| 35  | 0805      | H              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 36  | 0805      | H              | 4mm                 | 7 #       | Plastic           | 2          | P              |
| 37  | 0805      | H              | 4mm                 | 13 #      | Plastic           | 10         | O              |
| 38  | 1206      | E              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 39  | 1206      | E              | 4mm                 | 7 #       | Plastic           | 2          | P              |
| 40  | 1206      | O              | 4mm                 | 7 #       | Plastic           | 3          | R              |
| 41  | 1206      | O              | 4mm                 | 7 #       | Plastic           | 2          | P              |

Table 4 Packaging (Minimum Quantity)

| NO. | Size Code | Thickness Code | Square hole spacing | Disc Size | Carrier Tape Type | QTY (Kpcs) | Packaging Code |
|-----|-----------|----------------|---------------------|-----------|-------------------|------------|----------------|
| 42  | 1206      | L              | 4mm                 | 7 "       | Plastic           | 2          | P              |
| 43  | 1206      | L              | 4mm                 | 7 "       | Plastic           | 3          | R              |
| 44  | 1206      | L              | 4mm                 | 13 "      | Plastic           | 8          | E              |
| 45  | 1206      | P              | 4mm                 | 7 "       | Plastic           | 2          | P              |
| 46  | 1210      | L              | 4mm                 | 7 "       | Plastic           | 2          | P              |
| 47  | 1210      | Q              | 4mm                 | 7 "       | Plastic           | 1.5        | F              |
| 48  | 1210      | Q              | 4mm                 | 7 "       | Plastic           | 0.5        | S              |
| 49  | 1210      | Q              | 4mm                 | 7 "       | Plastic           | 1          | Z              |
| 50  | 1210      | R              | 4mm                 | 7 "       | Plastic           | 1          | Z              |
| 51  | 1210      | R              | 4mm                 | 7 "       | Plastic           | 0.5        | S              |
| 52  | 1210      | 3              | 4mm                 | 7 "       | Plastic           | 1          | Z              |

**First packaging:** Each multi-disc material is packed into a box.

**The second packaging:** the first packaged packaging box is loaded into the paper packaging box,and the remaining space in the box is filled with light auxiliary materials.

The above packaging forms can also be packaged according to user needs.

3. Technical Specifications and Test Methods

3.1 Operating Environment

| Temp. Characteristics | Temp. Range | Relative Humidity | Atmospheric Pressure |
|-----------------------|-------------|-------------------|----------------------|
| COG/X7R/X7S/X7T       | -55℃~125℃   | ≤95% (25℃)        | 86 KPa~106KPa        |
| X8G/X8R/X8L           | -55℃~150℃   | ≤95% (25℃)        | 86 KPa~106KPa        |

3.2 Reliability Test Specifications and Methods

Table 5: Specifications and Test Methods

| No.       | Item                                   |                   | Specification                                                                                    |                                                                 | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|-----------|----------------------------------------|-------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|-------------|--------------|-----------|------|---|------------------|------|------|----|------------------|-------|------------|------------------|-------|---------|--------------------|------|-------|---|------------------|-------|---|--------------------|-------|---|--------------------|-----------|----------------|-------------|--------------|------|------|---|------------------|-------|-------|------------------|-------|--------|--------------------|-------|---|--------------------|------|-------|---|--------------------|--------|---|--------------------|-------|---|--------------------|------|-------|---|--------------------|--------|--------|--------------------|--------|
|           | AEC-Q200 Test Item                     |                   | Class1 (Temperature Compensating Type)<br>COG/X8G                                                | Class 2 ( High dielectric constant type)<br>X8R/X8L/X7R/X7S/X7T |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 1         | Pre-and Post-Stress<br>Electrical Test |                   | —                                                                                                |                                                                 | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 2         | High Temperature<br>Exposure (Storage) | Appearance        | No defects or abnormalities.                                                                     |                                                                 | Pre-treatment<br>Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | Cap. Change       | ΔC/C≤±2.5% or ±0.25pF, (Whichever is larger)                                                     | See Table5-1                                                    | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | I.R. (Room Temp.) | ≥10000MΩ or 100Ω·F, (Whichever is smaller)                                                       | See Table5-1                                                    | Test temperature<br>150±3°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | D.F. or Q         | C≥30pF: Q≥1000<br>C < 30pF: Q≥400+20C<br>C: Nominal Capacitance (pF)                             | See Table5-1                                                    | Test time<br>1000±12h<br><br>Post-treatment<br>Set for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 3         | Temperature<br>Cycling                 | Appearance        | No defects or abnormalities.                                                                     |                                                                 | Pre-treatment<br>Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | Cap. Change       | ΔC/C≤±2.5% or ±0.25pF, (Whichever is larger)                                                     | See Table5-1                                                    | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | I.R. (Room Temp.) | ≥10000MΩ or 100Ω·F, (Whichever is smaller)                                                       | See Table5-1                                                    | Cycles<br>1000cycles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | D.F. or Q         | C≥30pF: Q≥1000<br>C < 30pF: Q≥400+20C<br>C: Nominal Capacitance (pF)                             | See Table5-1                                                    | Temperature Step<br><table><tr><th>Step</th><th>Temp.(°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>θ1</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>1</td></tr><tr><td>3</td><td>θ2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>1</td></tr></table><br>COG/X7R/X7S/X7T: θ1=-55°C,θ2=125°C<br>X8G/X8R/X8L: θ1=-55°C,θ2=150°C<br><br>Post-treatment<br>Set for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Step      | Temp.(°C)      | Time (min)  | 1            | θ1        | 30±3 | 2 | Room Temp.       | 1    | 3    | θ2 | 30±3             | 4     | Room Temp. | 1                |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| Step      | Temp.(°C)                              | Time (min)        |                                                                                                  |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 1         | θ1                                     | 30±3              |                                                                                                  |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 2         | Room Temp.                             | 1                 |                                                                                                  |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 3         | θ2                                     | 30±3              |                                                                                                  |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 4         | Room Temp.                             | 1                 |                                                                                                  |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 4         | Destructive Physical Analysis (DPA)    |                   | No defects or abnormalities.                                                                     |                                                                 | EIA-469                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 5         | Biased Humidity<br>(8585)              | Appearance        | No defects or abnormalities.                                                                     |                                                                 | Pre-treatment<br>Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | Cap. Change       | ΔC/C≤±3% or ±0.3pF (Whichever is larger)                                                         | See Table5-1                                                    | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | I.R. (Room Temp.) | ≥1000MΩ or 25Ω·F, (Whichever is smaller)                                                         | See Table5-1                                                    | Test temperature<br>85±3°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | D.F. or Q         | C≥30pF: Q≥200<br>C < 30pF: Q≥100+10C/3<br>C: Nominal Capacitance (pF)                            | See Table5-1                                                    | Test humidity<br>85±3%RH<br>Test time<br>1000±12h<br>Test voltage<br>Rated voltage(U <sub>k</sub> < 500V) and1.3Vdc to 1.5Vdc (Add 100kΩ resistor)<br>500±50V (U <sub>k</sub> =500V/630V/1KV/2KV) and1.3Vdc to 1.5Vdc (Add 100kΩ resistor)<br>The charge/discharge current<br>50mA or lower<br><br>Post-treatment<br>Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure.<br>Class 1: Set for 24±2 hours at room temperature, then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 6         | Operational Life                       | Appearance        | No defects or abnormalities.                                                                     |                                                                 | Pre-treatment<br>Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | Cap. Change       | ΔC/C≤±3% or ±0.3pF (Whichever is larger)                                                         | See Table5-1                                                    | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | I.R. (Room Temp.) | I.R.≥1000MΩ or 50Ω·F, (Whichever is smaller)                                                     | See Table5-1                                                    | Test temperature<br>θ2±3°C [COG/X7R/X7S/X7T:θ2=125°C, X8R/X8L/X8G:θ2=150°C]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | D.F. or Q         | C≥30pF: Q≥350<br>10pF≤C < 30pF: Q≥275+5C/2<br>C < 10pF: Q≥200+10C<br>C: Nominal Capacitance (pF) | See Table5-1                                                    | Test time<br>1000±12h<br>Test voltage<br><b>Class1:</b><br><table><tr><th>Size Code</th><th>U<sub>k</sub></th><th>Capacitance</th><th>Test voltage</th></tr><tr><td>0201,0402</td><td>-</td><td>-</td><td>2×U<sub>k</sub></td></tr><tr><td rowspan="3">0603</td><td>≤50V</td><td>-</td><td>2×U<sub>k</sub></td></tr><tr><td>=100V</td><td>≤1.5nF</td><td>2×U<sub>k</sub></td></tr><tr><td>=100V</td><td>&gt; 1.5nF</td><td>1.5×U<sub>k</sub></td></tr><tr><td rowspan="3">0805</td><td>≤100V</td><td>-</td><td>2×U<sub>k</sub></td></tr><tr><td>=250V</td><td>-</td><td>1.5×U<sub>k</sub></td></tr><tr><td>=630V</td><td>-</td><td>1.2×U<sub>k</sub></td></tr></table><br><table><tr><th>Size Code</th><th>U<sub>k</sub></th><th>Capacitance</th><th>Test voltage</th></tr><tr><td rowspan="4">1206</td><td>=50V</td><td>-</td><td>2×U<sub>k</sub></td></tr><tr><td>=100V</td><td>≤56nF</td><td>2×U<sub>k</sub></td></tr><tr><td>=100V</td><td>&gt; 56nF</td><td>1.5×U<sub>k</sub></td></tr><tr><td>=250V</td><td>-</td><td>1.5×U<sub>k</sub></td></tr><tr><td rowspan="3">1210</td><td>=630V</td><td>-</td><td>1.2×U<sub>k</sub></td></tr><tr><td>=1000V</td><td>-</td><td>1.2×U<sub>k</sub></td></tr><tr><td>=630V</td><td>-</td><td>1.2×U<sub>k</sub></td></tr><tr><td rowspan="3">1210</td><td>=630V</td><td>-</td><td>1.2×U<sub>k</sub></td></tr><tr><td>=1000V</td><td>≤2.2nF</td><td>1.2×U<sub>k</sub></td></tr><tr><td>=1000V</td><td>&gt; 2.2nF</td><td>1×U<sub>k</sub></td></tr></table><br><b>Class 2:</b> See Table5-1<br>The charge/discharge current<br>50mA or lower<br><br>Post-treatment<br>Class 2: Perform a heat treatment at 150 °C for 1hour and then sit for 24±2 hours at room temperature. Perform the initial measurement.<br>Class 1: Set for 24±2 hours at room temperature, then measure. | Size Code | U <sub>k</sub> | Capacitance | Test voltage | 0201,0402 | -    | - | 2×U <sub>k</sub> | 0603 | ≤50V | -  | 2×U <sub>k</sub> | =100V | ≤1.5nF     | 2×U <sub>k</sub> | =100V | > 1.5nF | 1.5×U <sub>k</sub> | 0805 | ≤100V | - | 2×U <sub>k</sub> | =250V | - | 1.5×U <sub>k</sub> | =630V | - | 1.2×U <sub>k</sub> | Size Code | U <sub>k</sub> | Capacitance | Test voltage | 1206 | =50V | - | 2×U <sub>k</sub> | =100V | ≤56nF | 2×U <sub>k</sub> | =100V | > 56nF | 1.5×U <sub>k</sub> | =250V | - | 1.5×U <sub>k</sub> | 1210 | =630V | - | 1.2×U <sub>k</sub> | =1000V | - | 1.2×U <sub>k</sub> | =630V | - | 1.2×U <sub>k</sub> | 1210 | =630V | - | 1.2×U <sub>k</sub> | =1000V | ≤2.2nF | 1.2×U <sub>k</sub> | =1000V |
| Size Code | U <sub>k</sub>                         | Capacitance       | Test voltage                                                                                     |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 0201,0402 | -                                      | -                 | 2×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 0603      | ≤50V                                   | -                 | 2×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =100V                                  | ≤1.5nF            | 2×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =100V                                  | > 1.5nF           | 1.5×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 0805      | ≤100V                                  | -                 | 2×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =250V                                  | -                 | 1.5×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =630V                                  | -                 | 1.2×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| Size Code | U <sub>k</sub>                         | Capacitance       | Test voltage                                                                                     |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 1206      | =50V                                   | -                 | 2×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =100V                                  | ≤56nF             | 2×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =100V                                  | > 56nF            | 1.5×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =250V                                  | -                 | 1.5×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 1210      | =630V                                  | -                 | 1.2×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =1000V                                 | -                 | 1.2×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =630V                                  | -                 | 1.2×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 1210      | =630V                                  | -                 | 1.2×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =1000V                                 | ≤2.2nF            | 1.2×U <sub>k</sub>                                                                               |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           | =1000V                                 | > 2.2nF           | 1×U <sub>k</sub>                                                                                 |                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 7         | Appearance                             |                   | No defects or abnormalities.                                                                     |                                                                 | Visual inspection under 10x microscope                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 8         | Physical Dimension                     |                   | See Fig.1                                                                                        |                                                                 | Using Measuring instrument of dimension                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
| 9         | Mechanical Shock                       | Appearance        | No defects or abnormalities.                                                                     |                                                                 | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | Cap. Change       | Within the specified initial value.                                                              | Within the specified initial value.                             | Solder the capacitor on the test substrate(glass epoxy board). Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | I.R. (Room Temp.) | ≥1000MΩ or 100Ω·F, (Whichever is smaller)                                                        | Within the specified initial value.                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |
|           |                                        | D.F. or Q         | Within the specified initial value.                                                              | Within the specified initial value.                             | Waveform<br>Half-sine<br>Holding Time<br>0.5ms<br>Peak value<br>1500g<br>Velocity change<br>4.7m/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                |             |              |           |      |   |                  |      |      |    |                  |       |            |                  |       |         |                    |      |       |   |                  |       |   |                    |       |   |                    |           |                |             |              |      |      |   |                  |       |       |                  |       |        |                    |       |   |                    |      |       |   |                    |        |   |                    |       |   |                    |      |       |   |                    |        |        |                    |        |

3.2 Reliability Test Specifications and Methods  
Table 5: Specifications and Test Methods

| No. | Item                         |                   | Specification                                                      |                                                                | Test Method                                                                                                                                                                           |                                                                                                                             |
|-----|------------------------------|-------------------|--------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|     | AEC-Q200 Test item           |                   | Class1 (Temperature Compensating Type)<br>C0G/X8G                  | Class 2 (High dielectric constant type)<br>X8R/X8L/X7R/X7S/X7T |                                                                                                                                                                                       |                                                                                                                             |
| 10  | Vibration                    | Appearance        | No defects or abnormalities.                                       |                                                                | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes. |                                                                                                                             |
|     |                              | Cap. Change       | Within the specified initial value.                                | Within the specified initial value.                            | Mounting method                                                                                                                                                                       | Solder the capacitor on the test substrate(glass epoxy board).                                                              |
|     |                              | I.R. (Room Temp.) | Within the specified initial value.                                | Within the specified initial value.                            | Kind of Vibration                                                                                                                                                                     | 10Hz to 2000Hz and return to 10Hz.                                                                                          |
|     |                              | D.F. or Q         | Within the specified initial value.                                | Within the specified initial value.                            | Total amplitude                                                                                                                                                                       | 1.5mm                                                                                                                       |
|     |                              |                   |                                                                    |                                                                | Vibration Time                                                                                                                                                                        | 20min.                                                                                                                      |
| 11  | Resistance to Soldering Heat |                   |                                                                    |                                                                | Vibration directions and time                                                                                                                                                         | This motion should be applied for 12 cycles in each 3 mutually perpendicular directions (total of 36 times).                |
|     |                              | Appearance        | No defects or abnormalities.                                       |                                                                | Pre-treatment                                                                                                                                                                         | Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure. |
|     |                              | Cap. Change       | Within the specified initial value.                                | Within the specified initial value.                            | Pre-heating                                                                                                                                                                           | Temp.:120°C~150°C/Time:60s                                                                                                  |
|     |                              | I.R. (Room Temp.) | ≥10000MΩ or 500Ω•F, (Whichever is smaller)                         | Within the specified initial value.                            | Test Method                                                                                                                                                                           | Solder bath method                                                                                                          |
|     |                              | D.F. or Q         | Within the specified initial value.                                | Within the specified initial value.                            | Solder alloy                                                                                                                                                                          | Sn-Ag-Cu(Lead Free Solder)                                                                                                  |
|     |                              |                   |                                                                    |                                                                | Solder temp.                                                                                                                                                                          | 260°C±5°C                                                                                                                   |
|     |                              |                   |                                                                    |                                                                | Duration of immersion                                                                                                                                                                 | 10±1s                                                                                                                       |
| 12  | ESD                          |                   |                                                                    |                                                                | Depth of immersion                                                                                                                                                                    | 10±1mm                                                                                                                      |
|     |                              | Appearance        | No defects or abnormalities.                                       |                                                                | Post-treatment                                                                                                                                                                        | Set for 24±2 hours at room temperature, then measure.                                                                       |
|     |                              | Cap. Change       | Within the specified initial value.                                | Within the specified initial value.                            | Per AEC-Q200-002                                                                                                                                                                      |                                                                                                                             |
|     |                              | I.R. (Room Temp.) | ≥10000MΩ or 100Ω•F, (Whichever is smaller)                         | Within the specified initial value.                            |                                                                                                                                                                                       |                                                                                                                             |
|     |                              | D.F. or Q         | Within the specified initial value.                                | Within the specified initial value.                            |                                                                                                                                                                                       |                                                                                                                             |
| 13  | Solderability                |                   |                                                                    |                                                                | Pre-treatment                                                                                                                                                                         | Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature. then measure. |
|     |                              | Appearance        | 95% of the terminations is to be soldered evenly and continuously  |                                                                | Pre-heating                                                                                                                                                                           | Temp.: 155°C/Time: 4h                                                                                                       |
| 14  |                              |                   |                                                                    |                                                                | Flux                                                                                                                                                                                  | Solution of rosin ethanol                                                                                                   |
|     |                              |                   |                                                                    |                                                                | Test Method                                                                                                                                                                           | Solder bath method                                                                                                          |
|     |                              |                   |                                                                    |                                                                | Solder alloy                                                                                                                                                                          | Sn-Ag-Cu(Lead Free Solder)                                                                                                  |
|     |                              |                   |                                                                    |                                                                | Solder temp.                                                                                                                                                                          | 245°C±5°C                                                                                                                   |
|     |                              |                   |                                                                    |                                                                | Duration of immersion                                                                                                                                                                 | 5.0±0.5s                                                                                                                    |
|     |                              |                   |                                                                    |                                                                | Depth of immersion                                                                                                                                                                    | 10±1mm                                                                                                                      |
|     |                              | Capacitance       | Within the specified tolerance                                     |                                                                | Measurement Temperature                                                                                                                                                               | 18 ~ 28°C                                                                                                                   |
| 15  |                              |                   |                                                                    |                                                                | Relative Humidity                                                                                                                                                                     | ≤RH 80%                                                                                                                     |
|     |                              | D.F. or Q         | C≥30pF: Q≥1000<br>C<30pF: Q≥400+20C<br>C: Nominal Capacitance (pF) | See Table5-1                                                   | Measurement Frequency                                                                                                                                                                 | Class 1: C≤1nF, f=1.0±0.1MHz; C>1nF, f=1.0±0.1KHz<br>Class 2: C≤10μF, f=1.0±0.1KHz; C>10μF, f=120±24Hz                      |
| 16  |                              |                   |                                                                    |                                                                | Measurement Voltage                                                                                                                                                                   | Class 1: 1.0±0.2Vrms<br>Class 2: C≤10μF, U=1.0±0.2Vrms; C>10μF, U=0.5±0.1Vrms                                               |
|     |                              | I.R. (Room Temp.) | I.R.≥100000MΩ or 500Ω•F, (Whichever is smaller)                    | See Table5-1                                                   | Measurement Temperature                                                                                                                                                               | 18 ~ 28°C                                                                                                                   |
| 17  | Electrical Characterization  |                   |                                                                    |                                                                | Relative Humidity                                                                                                                                                                     | ≤RH 80%                                                                                                                     |
|     |                              | I.R. (High Temp.) | ≥10000MΩ or 10Ω•F, (Whichever is smaller)                          | See Table5-1                                                   | Measurement Frequency                                                                                                                                                                 | Class 1: C≤1nF, f=1.0±0.1MHz; C>1nF, f=1.0±0.1KHz<br>Class 2: C≤10μF, f=1.0±0.1KHz; C>10μF, f=120±24Hz                      |
| 18  |                              |                   |                                                                    |                                                                | Measurement Voltage                                                                                                                                                                   | Class 1: 1.0±0.2Vrms<br>Class 2: C≤10μF, U=1.0±0.2Vrms; C>10μF, U=0.5±0.1Vrms                                               |
|     |                              | Voltage proof     | No defects or abnormalities.                                       |                                                                | Measurement Temperature                                                                                                                                                               | X8R/X8L/X8G: 150°C<br>C0G/X7R/X7S/X7T: 125°C                                                                                |
|     |                              |                   |                                                                    |                                                                | Measurement Voltage                                                                                                                                                                   | U <sub>1</sub> <500V: U <sub>0</sub><br>U <sub>0</sub> ≥500V: 500±50V                                                       |
|     |                              |                   |                                                                    |                                                                | Charging Time                                                                                                                                                                         | 1min                                                                                                                        |
|     |                              |                   |                                                                    |                                                                | The charge/discharge current                                                                                                                                                          | 50mA or lower                                                                                                               |
|     |                              |                   |                                                                    |                                                                | Measurement Temperature                                                                                                                                                               | X8R/X8L/X8G: 150°C<br>C0G/X7R/X7S/X7T: 125°C                                                                                |
|     |                              |                   |                                                                    |                                                                | Measurement Voltage                                                                                                                                                                   | U <sub>1</sub> <500V: U <sub>0</sub><br>U <sub>0</sub> ≥500V: 500±50V                                                       |
|     |                              |                   |                                                                    |                                                                | Charging Time                                                                                                                                                                         | 1min                                                                                                                        |
|     |                              |                   |                                                                    |                                                                | The charge/discharge current                                                                                                                                                          | 50mA or lower                                                                                                               |
|     |                              |                   |                                                                    |                                                                | Test Voltage                                                                                                                                                                          |                                                                                                                             |
|     |                              |                   |                                                                    |                                                                | Class 1                                                                                                                                                                               |                                                                                                                             |
|     |                              |                   |                                                                    |                                                                | Class 2                                                                                                                                                                               |                                                                                                                             |
|     |                              |                   |                                                                    |                                                                | Size Code                                                                                                                                                                             | U <sub>0</sub>                                                                                                              |
|     |                              |                   |                                                                    |                                                                | U <sub>0</sub>                                                                                                                                                                        | Test Voltage                                                                                                                |
|     |                              |                   |                                                                    |                                                                | < 250V                                                                                                                                                                                | ≤100V                                                                                                                       |
|     |                              |                   |                                                                    |                                                                | 250V                                                                                                                                                                                  | ≥2.5×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 630V                                                                                                                                                                                  | ≥2.0×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 1000V                                                                                                                                                                                 | ≥2.0×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 1206                                                                                                                                                                                  | ≥1.5×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 1000V                                                                                                                                                                                 | ≥1.3×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 1210                                                                                                                                                                                  | ≥1.5×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 630V                                                                                                                                                                                  | ≥1.5×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | 1000V                                                                                                                                                                                 | ≥2.2nF                                                                                                                      |
|     |                              |                   |                                                                    |                                                                | 2.2nF < C ≤ 15nF                                                                                                                                                                      | ≥1.3×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | > 15nF                                                                                                                                                                                | ≥1.2×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                |                                                                                                                                                                                       | ≥1.1×U <sub>0</sub>                                                                                                         |
|     |                              |                   |                                                                    |                                                                | Applied Time                                                                                                                                                                          | t=1s~5s                                                                                                                     |
|     |                              |                   |                                                                    |                                                                | The charge/discharge current                                                                                                                                                          | 50mA or lower                                                                                                               |
|     |                              |                   |                                                                    |                                                                |                                                                                                                                                                                       |                                                                                                                             |
|     |                              |                   |                                                                    |                                                                |                                                                                                                                                                                       |                                                                                                                             |
|     |                              |                   |                                                                    |                                                                |                                                                                                                                                                                       |                                                                                                                             |
|     |                              |                   |                                                                    |                                                                |                                                                                                                                                                                       |                                                                                                                             |

3.2 Reliability Test Specifications and Methods  
Table 5: Specifications and Test Methods

| No. | Item                                    |                                                                                                        | Specification                                                                  |                                                                                                                                                                             | Test Method                                                                                                                                                                           |
|-----|-----------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | AEC-Q200 Test Item                      |                                                                                                        | Class1 (Temperature Compensating Type)<br>COG/X8G                              | Class 2 ( High dielectric constant type)<br>X8R/X8L/X7R/X7S/X7T                                                                                                             |                                                                                                                                                                                       |
| 19  | Board Flex                              | Appearance                                                                                             | No defects or abnormalities.                                                   |                                                                                                                                                                             | Solder the capacitor on the test substrate See Fig.2                                                                                                                                  |
|     |                                         | Cap. Change                                                                                            | $\Delta C/C \leq \pm 5\%$ or $\pm 0.5pF$ (Whichever is larger)                 | Within the specified initial value.                                                                                                                                         | Pressurization Method : See Fig.3.                                                                                                                                                    |
|     |                                         | I.R. (Room Temp.)                                                                                      | $I.R. \geq 10000M\Omega$ or $500\Omega \cdot F$ , (Whichever is smaller)       | See Table5-1                                                                                                                                                                | Speed                                                                                                                                                                                 |
|     |                                         | D.F. or Q                                                                                              | Within the specified initial value.                                            | Within the specified initial value.                                                                                                                                         | Class1: 3mm<br>Class2: 2mm                                                                                                                                                            |
|     |                                         | Holding Time                                                                                           |                                                                                |                                                                                                                                                                             | 60s                                                                                                                                                                                   |
|     |                                         |                                                                                                        |                                                                                |                                                                                                                                                                             | then measure the capacitance.                                                                                                                                                         |
| 20  | Terminal Strength                       | Appearance                                                                                             | No defects or abnormalities.                                                   |                                                                                                                                                                             | Perform heat treatment 3 times according to Lead-free reflow soldering profiles, the peak temperature is 260°C, and the time gap between each heat treatment is more than 30 minutes. |
|     |                                         | Cap. Change                                                                                            | Within the specified initial value.                                            | Within the specified initial value.                                                                                                                                         | Mounting method                                                                                                                                                                       |
|     |                                         | I.R. (Room Temp.)                                                                                      | $I.R. \geq 10000M\Omega$ or $500\Omega \cdot F$ , (Whichever is smaller)       | See Table5-1                                                                                                                                                                | Applied Force                                                                                                                                                                         |
|     |                                         | D.F. or Q                                                                                              | Within the specified initial value.                                            | Within the specified initial value.                                                                                                                                         |                                                                                                                                                                                       |
| 21  | Beam Load Test                          | Destruction value                                                                                      | Destruction value should be exceed following one:                              |                                                                                                                                                                             | Mounting method                                                                                                                                                                       |
|     |                                         |                                                                                                        |                                                                                |                                                                                                                                                                             | Place the capacitor in the beam load fixture as Fig 5/6                                                                                                                               |
|     |                                         |                                                                                                        |                                                                                |                                                                                                                                                                             | Speed supplied the Stress Load                                                                                                                                                        |
|     |                                         |                                                                                                        |                                                                                |                                                                                                                                                                             | <Size Code:0805 max. ><br><Size Code:1206 min. >                                                                                                                                      |
|     |                                         |                                                                                                        |                                                                                |                                                                                                                                                                             |                                                                                                                                                                                       |
| 22  | Capacitance Temperature Characteristics | COG: $\alpha C \leq \pm 30ppm/^{\circ}C$ (125°C);<br>-72 $\leq \alpha C \leq +30ppm/^{\circ}C$ (-55°C) | X8R/X7R: $\Delta C/C \leq \pm 15\%$<br>X7S: $\Delta C/C \leq \pm 22\%$         | Pre-treatment<br>Class 2: Perform a heat treatment at 150°C+0/-10°C for 1hour and then sit for 24±2 hours at room temperature, then measure.                                |                                                                                                                                                                                       |
|     |                                         | X8G: $\alpha C \leq \pm 30ppm/^{\circ}C$ (150°C);<br>-72 $\leq \alpha C \leq +30ppm/^{\circ}C$ (-55°C) | X7T: -33% $\leq \Delta C/C \leq 22\%$<br>X8L: -40% $\leq \Delta C/C \leq 15\%$ | Pre-drying<br>Class 1: 16-24 hours<br><br>Measure the capacitance separately in 25°C, 01, 25°C, 02, 25°C, should satisfied related capacitance change characteristics.      |                                                                                                                                                                                       |
|     |                                         |                                                                                                        |                                                                                | COG/X7R/X7S/X7T<br>01=-55°C, 02=125°C<br><br>X8R/X8L/X8G<br>01=-55°C, 02=150°C<br><br>T.C. Measurement Voltage<br>Class 1: 1.0±0.2Vrms<br>Class 2: $\leq 1.0 \pm 0.2Vrms$ ※ |                                                                                                                                                                                       |

4. Packaging,Shipment and storage

4.1 Packaging

4.1.1 packaging type

Reel Packaging (standard carrier tape disc packaging),single disc smallest package See Table 4.

4.1.2 Carrier Tape size

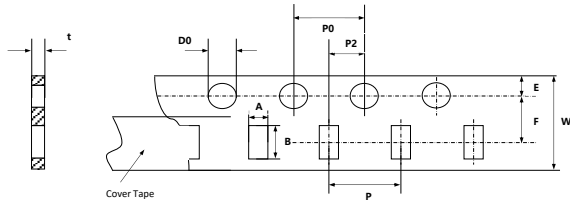


Fig. 7-1: 0603,0805 (Paper tape)

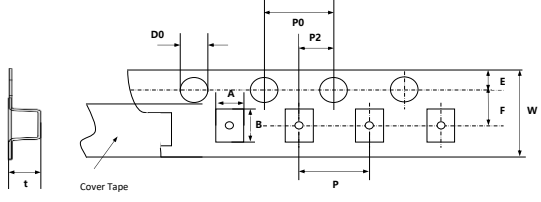


Fig. 7-2:0603,0805,1206,1210 (Plastic tape)

Table: 6-1 Carrier size (Size Code:0603,0805,1206,1210)

(Unit:mm)

| Size Code | Thickness code | Carrier Tape Type | Packaging Code | A         | B         | F         | P         | E         | D0        | P2        | K | W         | P0        | t       |
|-----------|----------------|-------------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---|-----------|-----------|---------|
| 0603      | D              | Paper             | T              | 1.00±0.10 | 1.80±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | D              | Paper             | A              | 1.00±0.10 | 1.80±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | D              | Plastic           | O              | 1.00±0.10 | 1.80±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | D              | Paper             | W              | 1.00±0.10 | 1.80±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | K              | Paper             | T              | 1.10±0.10 | 1.90±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | K              | Paper             | A              | 1.10±0.10 | 1.90±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | K              | Plastic           | O              | 1.10±0.10 | 1.90±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | K              | Paper             | W              | 1.10±0.10 | 1.90±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | K              | Plastic           | Q              | 1.10±0.10 | 1.90±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0603      | K              | Plastic           | R              | 1.10±0.10 | 1.90±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | C              | Paper             | T              | 1.45±0.10 | 2.20±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 0.9max  |
| 0805      | C              | Plastic           | R              | 1.45±0.10 | 2.20±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 0.9max  |
| 0805      | K              | Paper             | T              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | K              | Plastic           | R              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | K              | Plastic           | E              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | Y              | Paper             | T              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | Y              | Plastic           | E              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | Y              | Plastic           | P              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | Y              | Plastic           | R              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 0805      | G              | Plastic           | R              | 1.45±0.10 | 2.20±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.75max |
| 0805      | G              | Plastic           | P              | 1.45±0.10 | 2.20±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.75max |
| 0805      | G              | Plastic           | O              | 1.45±0.10 | 2.20±0.10 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.75max |
| 0805      | H              | Plastic           | R              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.00max |
| 0805      | H              | Plastic           | P              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.00max |
| 0805      | H              | Plastic           | O              | 1.45±0.20 | 2.20±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.00max |
| 1206      | E              | Plastic           | R              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 1206      | E              | Plastic           | P              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.15max |
| 1206      | O              | Plastic           | R              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.45max |
| 1206      | O              | Plastic           | P              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 1.45max |
| 1206      | L              | Plastic           | P              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1206      | L              | Plastic           | R              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1206      | L              | Plastic           | E              | 1.80±0.20 | 3.40±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1206      | P              | Plastic           | P              | 1.90±0.20 | 3.50±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1210      | L              | Plastic           | P              | 2.70±0.20 | 3.50±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.00max |
| 1210      | Q              | Plastic           | F              | 2.70±0.20 | 3.50±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1210      | Q              | Plastic           | S              | 2.70±0.20 | 3.50±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1210      | Q              | Plastic           | Z              | 2.70±0.20 | 3.50±0.20 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 2.50max |
| 1210      | R              | Plastic           | Z              | 2.70±0.20 | 3.50±0.30 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 3.00max |
| 1210      | R              | Plastic           | S              | 2.70±0.20 | 3.50±0.30 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 3.00max |
| 1210      | 3              | Plastic           | Z              | 2.70±0.30 | 3.50±0.40 | 3.50±0.05 | 4.00±0.10 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | / | 8.00±0.20 | 4.00±0.10 | 3.10max |

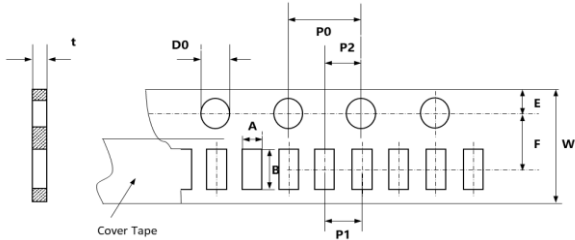


Fig. 7-3:0402 (Paper tape/ 2mm pitch)

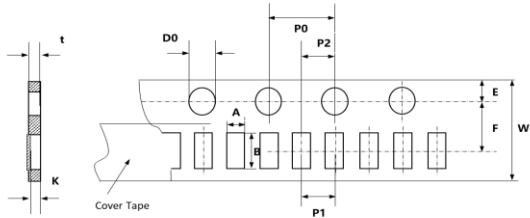


Fig. 7-4:0201 (Paper tape/ 2mm pitch)

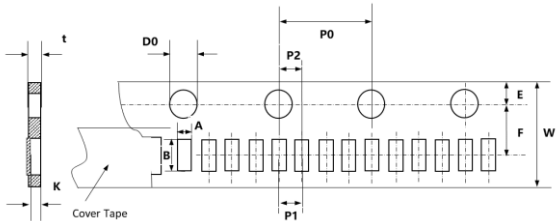


Fig. 7-5:0201 (Paper tape/ 1mm pitch)

Table 6-2: Carrier size (Size Code:0201,0402)

| (Unit:mm) |                |                   |                |           |           |           |           |           |           |           |           |           |           |        |  |
|-----------|----------------|-------------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------|--|
| Size Code | Thickness code | Carrier Tape Type | Packaging Code | A         | B         | F         | P1        | E         | D0        | P2        | K         | W         | P0        | t      |  |
| 0201      | A              | Paper             | T              | 0.38±0.02 | 0.68±0.03 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | 0.36±0.02 | 8.00±0.10 | 4.00±0.10 | 0.5max |  |
| 0201      | A              | Paper             | J              | 0.38±0.02 | 0.68±0.03 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | 0.36±0.02 | 8.00±0.10 | 4.00±0.10 | 0.5max |  |
| 0201      | A              | Paper             | H              | 0.38±0.02 | 0.68±0.03 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | 0.36±0.02 | 8.00±0.10 | 4.00±0.10 | 0.5max |  |
| 0201      | A              | Paper             | D              | 0.38±0.02 | 0.68±0.03 | 3.50±0.05 | 1.00±0.05 | 1.75±0.10 | 1.55±0.05 | 1.00±0.05 | 0.36±0.02 | 8.00±0.10 | 4.00±0.10 | 0.5max |  |
| 0201      | A              | Paper             | L              | 0.38±0.02 | 0.68±0.03 | 3.50±0.05 | 1.00±0.05 | 1.75±0.10 | 1.55±0.05 | 1.00±0.05 | 0.36±0.02 | 8.00±0.10 | 4.00±0.10 | 0.5max |  |
| 0201      | F              | Paper             | T              | 0.44±0.06 | 0.74±0.06 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | 0.40±0.05 | 8.00±0.10 | 4.00±0.10 | 0.6max |  |
| 0402      | B              | Paper             | T              | 0.63±0.05 | 1.13±0.05 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | /         | 8.00±0.10 | 4.00±0.10 | 0.8max |  |
| 0402      | B              | Paper             | J              | 0.63±0.05 | 1.13±0.05 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | /         | 8.00±0.10 | 4.00±0.10 | 0.8max |  |
| 0402      | N              | Paper             | T              | 0.70±0.10 | 1.20±0.10 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | /         | 8.00±0.10 | 4.00±0.10 | 0.8max |  |
| 0402      | N              | Paper             | J              | 0.70±0.10 | 1.20±0.10 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | /         | 8.00±0.10 | 4.00±0.10 | 0.8max |  |
| 0402      | C              | Paper             | T              | 0.75±0.10 | 1.30±0.10 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | /         | 8.00±0.10 | 4.00±0.10 | 0.8max |  |
| 0402      | C              | Paper             | J              | 0.75±0.10 | 1.30±0.10 | 3.50±0.05 | 2.00±0.05 | 1.75±0.10 | 1.55±0.05 | 2.00±0.05 | /         | 8.00±0.10 | 4.00±0.10 | 0.8max |  |

4.1.3 Disc size

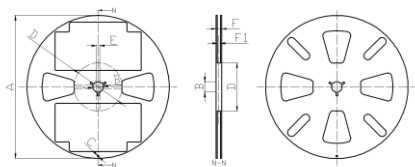


Fig. 8-1: disc (Width of carrier-4mm)

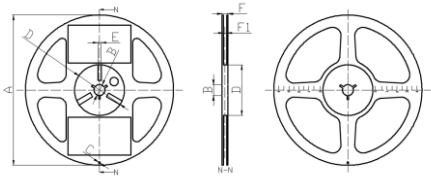


Fig. 8-2: disc (Width of carrier-8mm)

Table7: Disc size

| (Unit:mm) |                  |          |         |          |          |       |          |      |           |
|-----------|------------------|----------|---------|----------|----------|-------|----------|------|-----------|
| Disc size | Width of carrier | A        | B       | C        | D        | E     | F        | F1   | Size Code |
| 7"        | 8.00±0.10        | Φ178±2.0 | Φ13±1.0 | Φ4.0±0.5 | Φ60±2.0  | 4±1.0 | 11.5±1.0 | 10±2 | All       |
| 13"       | 8.00±0.10        | Φ330±2.0 | Φ13±1.0 | Φ4.0±0.5 | Φ108±2.0 | 4±1.0 | 13.5±2.0 | 10±2 | All       |

4.1.4 Carrier Tape specifications

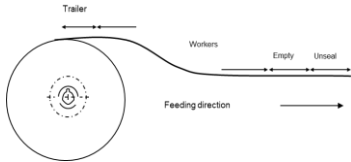


Fig 9 Carrier

| Packaging | The minimum length of the reserved spaces |        |        |
|-----------|-------------------------------------------|--------|--------|
| Carrier   | Trailer                                   | Empty  | Unseal |
|           | 60 mm                                     | 200 mm | 160 mm |

4.1.5 Performance of Carrier Taping

4.1.5.1 Strength of Carrier Tape and Top Cover Tape

a. Carrier Tape

When a tensile force 1.02kgf is applied in the direction to unroll the tape, the tape shall withstand this force.

b. Top cover Tape

When a tensile force 1.02kgf is applied to the tape, the tape shall withstand this force.

4.1.5.2 Peeling Strength of Top Cover Tape

Unless otherwise specified, the peeling strength of top cover tape shall be within 10.2 to 71.4 gf when the top cover tape is pulled at a speed of 300mm/min with the angle of 0 to 15° (see Fig.10).

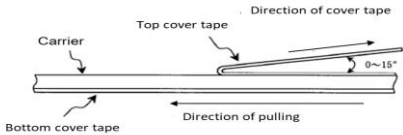


Fig. 10 Cover tape peel-off force

4.2 Shipment

Transport packaging products to adapt to the modern means of transport, but the product in the process of transport to prevent rain and acid and alkali corrosion, shall not be whipped extrusion casting and gravity.

4.3 Storage

4.3.1 Storage conditions:

The recommended temperature is less than 30°C.

A temperature is +5°C to +40°C and a relative humidity is 20% to 70% as a standard condition, (MSL Level 1)

MLCC may be affected by the storage conditions. Please use them promptly after delivery.

High temperature and humidity conditions and/or prolonged storage may cause deterioration of the packaging materials.

If more than six months have elapsed since delivery, check packaging, mounting, etc. before use.

4.3.2 Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor solderability.

Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)

## 5. MLCC Application of Technical Requirements

### 5.1 Circuit Design

#### 5.1.1 Operating Temperature

- Do not use capacitor above the maximum allowable operating temperature.
- Surface temperature including self-heating should be below maximum operating temperature.

#### 5.1.2 Operating Voltage

The operating voltage for capacitors must always be lower than their rated voltage.

### 5.2 PCB Design

#### 5.2.1 Design of Land-patterns

When the capacitors are mounted on a PCB, the amount of solder at the terminations has a direct effect on the performance of the capacitors.

The greater the amount of solder, the higher the stress on the capacitor. Therefore, when designing land-patterns, it is necessary to consider the appropriate size and configuration of the solder pads.

Size and recommended land dimensions are shown in the following figure and table:



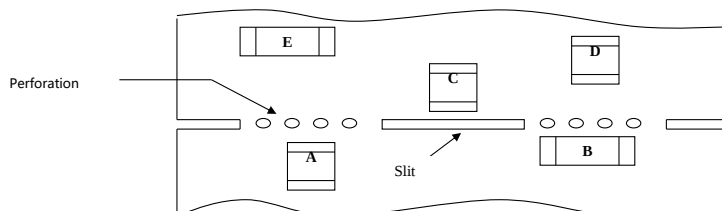
Recommended land dimensions for reflow-soldering

(unit: mm)

| Size Code | Length | Width | Tolerance                | A         | B         | C         |
|-----------|--------|-------|--------------------------|-----------|-----------|-----------|
| 0201      | 0.6    | 0.3   | $\pm 0.03$               | 0.20~0.25 | 0.20~0.30 | 0.20~0.35 |
| 0201      | 0.6    | 0.3   | $\pm 0.05$               | 0.20~0.25 | 0.25~0.35 | 0.30~0.40 |
| 0201      | 0.6    | 0.3   | $\pm 0.09/\pm 0.1$       | 0.23~0.30 | 0.25~0.35 | 0.30~0.40 |
| 0402      | 1      | 0.5   | $\pm 0.05$               | 0.30~0.50 | 0.35~0.45 | 0.40~0.60 |
| 0402      | 1      | 0.5   | $\pm 0.15$ or $\pm 0.20$ | 0.40~0.60 | 0.40~0.50 | 0.50~0.70 |
| 0603      | 1.6    | 0.8   | $\pm 0.10$               | 0.60~0.80 | 0.60~0.70 | 0.60~0.80 |
| 0603      | 1.6    | 0.8   | $\pm 0.20$               | 0.70~0.90 | 0.70~0.80 | 0.80~1.00 |
| 0805      | 2.0    | 1.25  | $\pm 0.10$ or $\pm 0.20$ | 1.00~1.40 | 0.60~0.80 | 1.20~1.40 |
| 1206      | 3.2    | 1.6   | $\pm 0.20$               | 1.80~2.00 | 1.00~1.20 | 1.50~1.70 |
| 1210      | 3.2    | 2.5   | $\pm 0.20$               | 2.00~2.40 | 1.00~1.20 | 1.80~2.30 |

#### 5.2.2 Capacitor Layout on PC Board

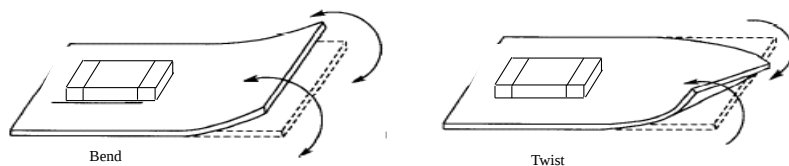
Mechanical stress varies according to the location of capacitors on PC board. The recommendation for better design is as follows:



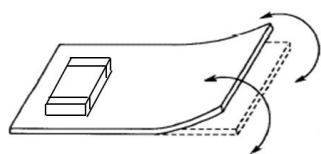
The stress in capacitors is in the following order:  $A > B > C > D > E$

Pay attention not to bend or distort the PC board otherwise the capacitor may crack. Please refer to the following examples of good and bad capacitor layout.

- Not recommended

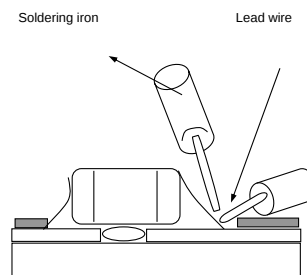
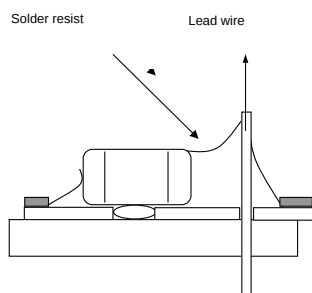
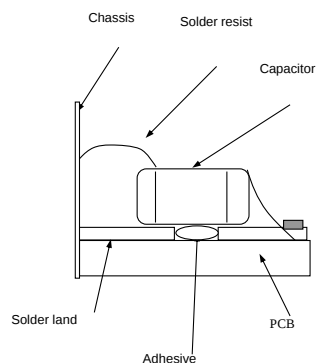


b.Recommended

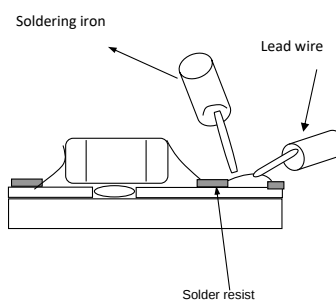
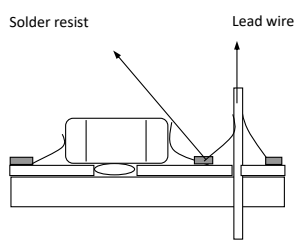
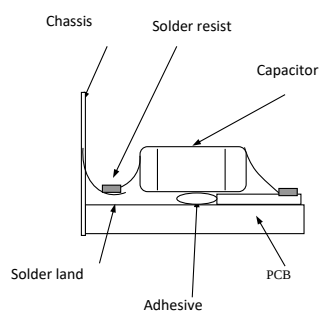


### 5.2.3 Solder Buildup and Soldering

a.Examples of soldering method not recommended



b.Examples of soldering method recommended



### 5.3 Consideration for Automatic Placement

If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitor to result in cracking. Please take following precautions

a.Adjust the bottom dead center of the mounting head to reach on the PC board surface and not press it;

b.Adjust the mounting head pressure to be 1N to 3N of static weight;

c.To minimize the impact energy from mounting head, it is important to provide support from the bottom side of the PC board.

Please refer to the following samples:

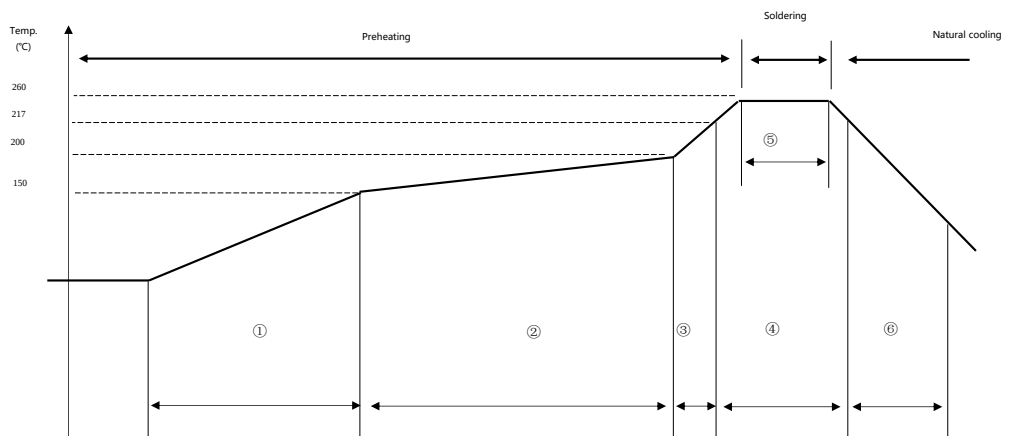
| Mounting              | Not recommended | Recommended |
|-----------------------|-----------------|-------------|
| Singel-sided Mounting |                 |             |
| Double-sided Mounting |                 |             |

## 5.4 Soldering

### 5.4.1 Flux Selection

- It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.
- Please provide proper amount of flux. Excessive flux must be avoided.
- When water-soluble flux is used, enough washing is necessary.

### 5.4.2 Recommended Soldering Profile

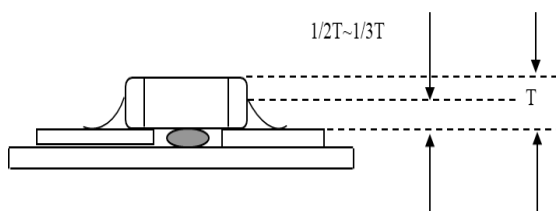


#### 5.4.2.1 Reflow Soldering Condition

| NO. | Reflow Soldering zone | Reflow Soldering Condition                                                    |
|-----|-----------------------|-------------------------------------------------------------------------------|
| ①   | Preheating 1          | $\leq 3^{\circ}\text{C/s}; \geq 60\text{s}$                                   |
| ②   | Constant temperature  | $150 \sim 200^{\circ}\text{C}; 60 \sim 120\text{s}; \leq 1^{\circ}\text{C/s}$ |
| ③   | Preheating 2          | $1 \sim 5^{\circ}\text{C/s}$                                                  |
| ④   | Soldering 1           | Above $217^{\circ}\text{C}$ , $60 \sim 150\text{s}$                           |
| ⑤   | Soldering 2           | Above $260^{\circ}\text{C}$ , over $10\text{s}$                               |
| ⑥   | Natural cooling       | $\leq 6^{\circ}\text{C/s}$                                                    |

#### Caution:

- Excessive solder will induce higher tensile force in chip capacitor when temperature changes and result in cracking. Insufficient solder may detach the capacitor from the PC board.  
The ideal condition is to have solder mass controlled to 1/2 to 1/3 of the thickness of the capacitor



- Soldering duration should be kept as close to recommended times as possible, because excessive duration can detrimentally affect solderability.
- The peak temperature of reflow soldering is  $245 \pm 15^{\circ}\text{C}$ .

## 6. All products in this specification comply with the EU RoHS directive

The EU RoHS Directive refers to the "Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment" stipulated by the European Union.

Table 5-1 Cap, D.F, I.R. changes after test

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage (DC) | Thickness code | Capacitance | High Temperature Exposure (Storage) |                          |             | Temperature Cycling   |                          |             | Biased Humidity (B585) |                          |             | Operational Life      |                          |             | Electrical Characterization |             |                          |                          |                            |                       | Board Flex               |                          | Terminal Strength |  |
|-----|-------------|-----------------------------|-----------|--------------------|----------------|-------------|-------------------------------------|--------------------------|-------------|-----------------------|--------------------------|-------------|------------------------|--------------------------|-------------|-----------------------|--------------------------|-------------|-----------------------------|-------------|--------------------------|--------------------------|----------------------------|-----------------------|--------------------------|--------------------------|-------------------|--|
|     |             |                             |           |                    |                |             | Cap. Change [ΔC/Cs %]               | I.R. (Room Temp.) [min.] | D.F. [max.] | Cap. Change [ΔC/Cs %] | I.R. (Room Temp.) [min.] | D.F. [max.] | Cap. Change [ΔC/Cs %]  | I.R. (Room Temp.) [min.] | D.F. [max.] | Cap. Change [ΔC/Cs %] | I.R. (Room Temp.) [min.] | D.F. [max.] | Test voltage [Vrms]         | D.F. [max.] | I.R. (Room Temp.) [min.] | I.R. (High Temp.) [min.] | Measurement Voltage [Vrms] | Measurement Frequency | I.R. (Room Temp.) [min.] | I.R. (Room Temp.) [min.] |                   |  |
| 1   | E           | X7R                         | 0201      | 25V                | A              | 100pF~3.3nF | 10                                  | 10000MΩ                  | 0.03        | 10                    | 10000MΩ                  | 0.03        | 12.5                   | 1000MΩ                   | 0.05        | 12.5                  | 1000MΩ                   | 0.05        | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 2   | E           | X7R                         | 0201      | 16V                | A              | 330pF~4.7nF | 10                                  | 10000MΩ                  | 0.05        | 10                    | 10000MΩ                  | 0.05        | 12.5                   | 1000MΩ                   | 0.05        | 12.5                  | 1000MΩ                   | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 3   | E           | X7R                         | 0201      | 10V                | A              | 1.2nF~10nF  | 10                                  | 10000MΩ                  | 0.05        | 10                    | 10000MΩ                  | 0.05        | 12.5                   | 1000MΩ                   | 0.05        | 12.5                  | 1000MΩ                   | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 4   | E           | X7R                         | 0402      | 100V               | B              | 220pF~4.7nF | 10                                  | 10000MΩ                  | 0.03        | 10                    | 10000MΩ                  | 0.03        | 12.5                   | 1000MΩ                   | 0.035       | 12.5                  | 1000MΩ                   | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 5   | E           | X7R                         | 0402      | 50V                | B              | 220pF~22nF  | 10                                  | 10000MΩ                  | 0.03        | 10                    | 10000MΩ                  | 0.03        | 12.5                   | 1000MΩ                   | 0.035       | 12.5                  | 1000MΩ                   | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 6   | E           | X7R                         | 0402      | 50V                | B              | 33nF~100nF  | 10                                  | 500Ω                     | 0.2         | 7.5                   | 500Ω                     | 0.1         | 12.5                   | 12.5Ω                    | 0.2         | 12.5                  | 250Ω                     | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 7   | E           | X7R                         | 0402      | 25V                | B              | 4.7nF~27nF  | 10                                  | 10000MΩ                  | 0.03        | 10                    | 10000MΩ                  | 0.03        | 12.5                   | 1000MΩ                   | 0.05        | 12.5                  | 1000MΩ                   | 0.05        | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 8   | E           | X7R                         | 0402      | 25V                | B              | 33nF~47nF   | 10                                  | 10000MΩ                  | 0.05        | 10                    | 10000MΩ                  | 0.05        | 12.5                   | 1000MΩ                   | 0.05        | 12.5                  | 1000MΩ                   | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 9   | E           | X7R                         | 0402      | 25V                | B              | 100nF       | 10                                  | 500Ω                     | 0.2         | 7.5                   | 500Ω                     | 0.1         | 12.5                   | 12.5Ω                    | 0.2         | 12.5                  | 250Ω                     | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 10  | E           | X7R                         | 0402      | 16V                | B              | 220pF~22nF  | 10                                  | 10000MΩ                  | 0.03        | 10                    | 10000MΩ                  | 0.03        | 12.5                   | 1000MΩ                   | 0.05        | 12.5                  | 1000MΩ                   | 0.05        | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 11  | E           | X7R                         | 0402      | 16V                | B              | 27nF~100nF  | 10                                  | 10000MΩ or 500Ω          | 0.05        | 10                    | 10000MΩ or 500Ω          | 0.05        | 12.5                   | 1000MΩ or 500Ω           | 0.05        | 12.5                  | 1000MΩ or 500Ω           | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 10000MΩ or 500Ω          | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 12  | E           | X7R                         | 0402      | 16V                | B              | 120nF~220nF | 10                                  | 500Ω                     | 0.2         | 7.5                   | 500Ω                     | 0.1         | 12.5                   | 12.5Ω                    | 0.2         | 12.5                  | 250Ω                     | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 13  | E           | X7R                         | 0402      | 10V                | B              | 100nF       | 10                                  | 500Ω                     | 0.05        | 10                    | 500Ω                     | 0.05        | 12.5                   | 500Ω                     | 0.05        | 12.5                  | 500Ω                     | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 14  | E           | X7R                         | 0402      | 10V                | B              | 120nF~220nF | 10                                  | 500Ω                     | 0.2         | 7.5                   | 500Ω                     | 0.1         | 12.5                   | 12.5Ω                    | 0.2         | 12.5                  | 250Ω                     | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 15  | E           | X7R                         | 0603      | 100V               | D              | 150pF~4.7nF | 10                                  | 10000MΩ                  | 0.03        | 10                    | 10000MΩ                  | 0.03        | 12.5                   | 1000MΩ                   | 0.035       | 12.5                  | >1000MΩ                  | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ                  | 10000MΩ                  |                   |  |
| 16  | E           | X7R                         | 0603      | 50V                | D              | 150pF~100nF | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 17  | E           | X7R                         | 0603      | 50V                | D              | 120nF~220nF | 10                                  | 500Ω                     | 0.05        | 10                    | 500Ω                     | 0.05        | 12.5                   | 500Ω                     | 0.05        | 12.5                  | 500Ω                     | 0.05        | 1.5×U <sub>R</sub>          | 0.035       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 18  | E           | X7R                         | 0603      | 25V                | D              | 150pF~100nF | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 19  | E           | X7R                         | 0603      | 25V                | D              | 120nF~330nF | 10                                  | 500Ω                     | 0.05        | 10                    | 500Ω                     | 0.05        | 12.5                   | 500Ω                     | 0.05        | 12.5                  | 500Ω                     | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 20  | E           | X7R                         | 0603      | 25V                | D              | 470nF~1μF   | 12.5                                | 500Ω                     | 0.1         | 10                    | 500Ω                     | 0.1         | 12.5                   | 50Ω                      | 0.2         | 12.5                  | 50Ω                      | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 21  | E           | X7R                         | 0603      | 16V                | D              | 150pF~100nF | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 22  | E           | X7R                         | 0603      | 16V                | D              | 120nF~470nF | 10                                  | 500Ω                     | 0.05        | 10                    | 500Ω                     | 0.05        | 12.5                   | 500Ω                     | 0.05        | 12.5                  | 500Ω                     | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 23  | E           | X7R                         | 0603      | 16V                | D              | 680nF~1μF   | 10                                  | 500Ω                     | 0.1         | 10                    | 500Ω                     | 0.1         | 12.5                   | 500Ω                     | 0.1         | 12.5                  | 500Ω                     | 0.1         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 24  | E           | X7R                         | 0603      | 6.3V               | D              | 2.2μF       | 10                                  | 500Ω                     | 0.2         | 7.5                   | 500Ω                     | 0.1         | 12.5                   | 12.5Ω                    | 0.2         | 12.5                  | 250Ω                     | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 25  | E           | X7R                         | 0805      | 250V               | Y              | 10nF        | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 1.5×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 26  | E           | X7R                         | 0805      | 100V               | Y              | 1nF~100nF   | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 27  | E           | X7R                         | 0805      | 50V                | Y              | 1nF~100nF   | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 28  | E           | X7R                         | 0805      | 50V                | H              | 220nF~470nF | 10                                  | 500Ω                     | 0.03        | 10                    | 500Ω                     | 0.03        | 12.5                   | 500Ω                     | 0.035       | 12.5                  | 500Ω                     | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 29  | E           | X7R                         | 0805      | 50V                | H              | 680nF~1μF   | 10                                  | 500Ω                     | 0.03        | 10                    | 500Ω                     | 0.03        | 12.5                   | 500Ω                     | 0.035       | 12.5                  | 500Ω                     | 0.035       | 1.5×U <sub>R</sub>          | 0.025       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 30  | E           | X7R                         | 0805      | 25V                | Y              | 1nF~100nF   | 10                                  | 10000MΩ or 500Ω          | 0.03        | 10                    | 10000MΩ or 500Ω          | 0.03        | 12.5                   | 1000MΩ or 500Ω           | 0.035       | 12.5                  | 1000MΩ or 500Ω           | 0.035       | 2.0×U <sub>R</sub>          | 0.025       | 10000MΩ or 500Ω          | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500Ω          | 10000MΩ or 500Ω          |                   |  |
| 31  | E           | X7R                         | 0805      | 25V                | H              | 220nF~1μF   | 10                                  | 500Ω                     | 0.03        | 10                    | 500Ω                     | 0.03        | 12.5                   | 500Ω                     | 0.05        | 12.5                  | 500Ω                     | 0.05        | 2.0×U <sub>R</sub>          | 0.025       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 32  | E           | X7R                         | 0805      | 25V                | H              | 2.2μF       | 12.5                                | 500Ω                     | 0.1         | 10                    | 500Ω                     | 0.1         | 12.5                   | 50Ω                      | 0.2         | 12.5                  | 50Ω                      | 0.2         | 1.5×U <sub>R</sub>          | 0.1         | 500Ω                     | 50Ω                      | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 33  | E           | X7R                         | 0805      | 16V                | H              | 1μF         | 10                                  | 500Ω                     | 0.05        | 10                    | 500Ω                     | 0.05        | 12.5                   | 500Ω                     | 0.05        | 12.5                  | 500Ω                     | 0.05        | 2.0×U <sub>R</sub>          | 0.035       | 500Ω                     | 100Ω                     | 1.0±0.2                    | 1.0±0.1kHz            | 500Ω                     | 500Ω                     |                   |  |
| 34  | E           | X7R                         | 0805      | 16V                | H              | 2.2μF       | 10                                  | 500Ω                     | 0.05        | 10                    | 500Ω                     | 0.05        | 12.5                   | 500Ω                     |             |                       |                          |             |                             |             |                          |                          |                            |                       |                          |                          |                   |  |

Table 5-1 Cap, D.F, I.R. changes after test

| NO. | Series Code | Temperature Characteristics | Size Code | Rated Voltage (DC) | Thickness code | Capacitance | High Temperature Exposure (Storage) |                          |             | Temperature Cycling  |                          |             | Biased Humidity (B58B) |                          |             | Operational Life     |                          |             |                     | Electrical Characterization |                          |                          |                            |                       | Board Flex       | Terminal Strength |
|-----|-------------|-----------------------------|-----------|--------------------|----------------|-------------|-------------------------------------|--------------------------|-------------|----------------------|--------------------------|-------------|------------------------|--------------------------|-------------|----------------------|--------------------------|-------------|---------------------|-----------------------------|--------------------------|--------------------------|----------------------------|-----------------------|------------------|-------------------|
|     |             |                             |           |                    |                |             | Cap. Change [ΔC/C±%]                | I.R. (Room Temp.) [min.] | D.F. [max.] | Cap. Change [ΔC/C±%] | I.R. (Room Temp.) [min.] | D.F. [max.] | Cap. Change [ΔC/C±%]   | I.R. (Room Temp.) [min.] | D.F. [max.] | Cap. Change [ΔC/C±%] | I.R. (Room Temp.) [min.] | D.F. [max.] | Test voltage [Vrms] | D.F. [max.]                 | I.R. (Room Temp.) [min.] | I.R. (High Temp.) [min.] | Measurement Voltage [Vrms] | Measurement Frequency |                  |                   |
| 72  | E           | X7S                         | 0805      | 25V                | H              | 4.7μF       | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 73  | E           | X7S                         | 0805      | 25V                | H              | 10μF        | 20                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 20                   | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 74  | E           | X7S                         | 0805      | 16V                | H              | 10μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 75  | E           | X7S                         | 0805      | 10V                | G              | 4.7μF       | 12.5                                | 500LF                    | 0.1         | 10                   | 500LF                    | 0.1         | 12.5                   | 50LF                     | 0.2         | 12.5                 | 500LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 76  | E           | X7S                         | 1206      | 100V               | L              | 2.2μF       | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 77  | E           | X7S                         | 1206      | 50V                | L              | 2.2μF       | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 78  | E           | X7S                         | 1206      | 25V                | P              | 10μF        | 10                                  | 5000LF                   | 0.03        | 10                   | 5000LF                   | 0.03        | 12.5                   | 500LF                    | 0.05        | 12.5                 | 500LF                    | 0.05        | 1.5×U <sub>0</sub>  | 0.025                       | 5000LF                   | 100LF                    | 1.0±0.2                    | 1.0±0.1kHz            | 5000F            | 5000F             |
| 79  | E           | X7S                         | 1206      | 16V                | P              | 10μF        | 10                                  | 5000LF                   | 0.03        | 10                   | 5000LF                   | 0.03        | 12.5                   | 500LF                    | 0.05        | 12.5                 | 500LF                    | 0.05        | 1.5×U <sub>0</sub>  | 0.025                       | 5000LF                   | 100LF                    | 1.0±0.2                    | 1.0±0.1kHz            | 5000F            | 5000F             |
| 80  | E           | X7S                         | 1206      | 16V                | P              | 22μF        | 15                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 81  | E           | X7S                         | 1210      | 50V                | R              | 10μF        | 10                                  | 5000LF                   | 0.03        | 10                   | 5000LF                   | 0.03        | 12.5                   | 500LF                    | 0.035       | 12.5                 | 500LF                    | 0.035       | 1.5×U <sub>0</sub>  | 0.025                       | 5000LF                   | 100LF                    | 1.0±0.2                    | 1.0±0.1kHz            | 5000F            | 5000F             |
| 82  | E           | X7S                         | 1210      | 25V                | R              | 10μF        | 10                                  | 5000LF                   | 0.03        | 10                   | 5000LF                   | 0.03        | 12.5                   | 500LF                    | 0.035       | 12.5                 | 500LF                    | 0.035       | 1.5×U <sub>0</sub>  | 0.025                       | 5000LF                   | 100LF                    | 1.0±0.2                    | 1.0±0.1kHz            | 5000F            | 5000F             |
| 83  | E           | X7S                         | 1210      | 25V                | 3              | 22μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 84  | E           | X7S                         | 1210      | 10V                | R              | 47μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 85  | E           | X7T                         | 0201      | 2.5V               | F              | 1μF         | 12.5                                | 0.50LF                   | 0.2         | 15                   | 500LF                    | 0.1         | 12.5                   | 0.50LF                   | 0.2         | 12.5                 | 0.50LF                   | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 86  | E           | X7T                         | 0402      | 4V                 | C              | 4.7μF       | 15                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 15                   | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 87  | E           | X7T                         | 0402      | 2.5V               | C              | 10μF        | 15                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 15                   | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 88  | E           | X7T                         | 0603      | 6.3V               | K              | 4.7μF       | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 89  | E           | X7T                         | 0603      | 6.3V               | K              | 10μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 90  | E           | X7T                         | 0603      | 4V                 | K              | 10μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 91  | E           | X7T                         | 0805      | 50V                | H              | 2.2μF       | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 92  | E           | X7T                         | 0805      | 16V                | H              | 10μF        | 12.5                                | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 93  | E           | X7T                         | 0805      | 10V                | H              | 10μF        | 12.5                                | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 94  | E           | X7T                         | 0805      | 6.3V               | H              | 10μF        | 12.5                                | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 95  | E           | X7T                         | 0805      | 6.3V               | H              | 22μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 96  | E           | X7T                         | 0805      | 4V                 | H              | 22μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 97  | E           | X7T                         | 1206      | 50V                | P              | 10μF        | 10                                  | 500LF                    | 0.2         | 7.5                  | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 1.0±0.2                    | 1.0±0.1kHz            | 500F             | 500F              |
| 98  | E           | X7T                         | 1206      | 6.3V               | L              | 22μF        | 12.5                                | 500LF                    | 0.2         | 12.5                 | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 99  | E           | X7T                         | 1206      | 4V                 | L              | 47μF        | 15                                  | 500LF                    | 0.2         | 30                   | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 15                   | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 100 | E           | X7T                         | 1210      | 6.3V               | R              | 22μF        | 12.5                                | 500LF                    | 0.2         | 12.5                 | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 101 | E           | X7T                         | 1210      | 6.3V               | R              | 47μF        | 12.5                                | 500LF                    | 0.2         | 12.5                 | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 12.5                 | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 102 | E           | X7T                         | 1210      | 2.5V               | 3              | 220μF       | 15                                  | 500LF                    | 0.2         | 30                   | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 15                   | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 103 | E           | X7T                         | 1210      | 2.5V               | 3              | 100μF       | 15                                  | 500LF                    | 0.2         | 30                   | 500LF                    | 0.1         | 12.5                   | 1250LF                   | 0.2         | 15                   | 250LF                    | 0.2         | 1.5×U <sub>0</sub>  | 0.1                         | 500LF                    | 50F                      | 0.5±0.1                    | 120±24Hz              | 500F             | 500F              |
| 104 | E           | X8R                         | 0402      | 50V                | B              | 220pF~1nF   | 10                                  | 10000MΩ or 500LF         | 0.06        | 10                   | 10000MΩ or 500LF         | 0.06        | 12.5                   | 500MΩ or 250LF           | 0.06        | 12.5                 | 1000MΩ or 500LF          | 0.06        | 2.0×U <sub>0</sub>  | 0.03                        | 10000MΩ or 500LF         | 1000MΩ or 100LF          | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ or 500LF | 10000MΩ or 500LF  |
| 105 | E           | X8R                         | 0603      | 100V               | D              | 1nF~10nF    | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 106 | E           | X8R                         | 0603      | 50V                | D              | 1nF~6.8nF   | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 1000MΩ                   | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 107 | E           | X8R                         | 0603      | 50V                | D              | 10nF~47nF   | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 100F                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 108 | E           | X8R                         | 0603      | 25V                | D              | 68nF~100nF  | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 100F                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 109 | E           | X8R                         | 0805      | 100V               | K              | 10nF~33nF   | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 100F                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 110 | E           | X8R                         | 0805      | 100V               | H              | 33nF~47nF   | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 100F                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 111 | E           | X8R                         | 0805      | 50V                | K              | 10nF~33nF   | 10                                  | 3000MΩ                   | 0.075       | 10                   | 10000MΩ                  | 0.075       | 12.5                   | 1000MΩ                   | 0.075       | 12.5                 | 1000MΩ                   | 0.075       | 2.0×U <sub>0</sub>  | 0.05                        | 10000MΩ                  | 100F                     | 1.0±0.2                    | 1.0±0.1kHz            | 10000MΩ          | 10000MΩ           |
| 112 | E           | X8R                         | 0805      | 50V                | G              | 33nF~100nF  |                                     |                          |             |                      |                          |             |                        |                          |             |                      |                          |             |                     |                             |                          |                          |                            |                       |                  |                   |