

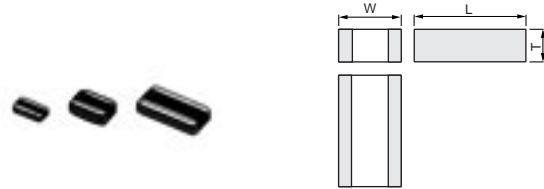
Chip Monolithic Ceramic Capacitors



Low ESL LLL/LLA/LLM Series

■ Features (Reversed geometry Low ESL Type)

1. Low ESL, good for noise reduction for high frequency
2. Small, high cap



■ Applications

1. High speed micro processor
2. High frequency digital equipment

| Part Number | Dimensions (mm) | | |
|-------------|-----------------|-----------|-----------|
| | L | W | T |
| LLL185 | 1.6 ±0.1 | 0.8 ±0.1 | 0.6 max. |
| LLL216 | 2.0 ±0.1 | 1.25 ±0.1 | 0.6 ±0.1 |
| LLL219 | | | 0.85 ±0.1 |
| LLL317 | 3.2 ±0.15 | 1.6 ±0.15 | 0.7 ±0.1 |
| LLL31M | | | 1.15 ±0.1 |

Reversed geometry Low ESL Type

| Part Number | LLL18 | | | | | | LLL21 | | | | | | LLL31 | | | | | |
|--|----------|---------|---------|----------|----------|---------|----------|----------|----------|----------|----------|--------|----------|----------|---------|----------|----------|----------|
| L x W | 1.6x0.8 | | | | | | 2.0x1.25 | | | | | | 3.2x1.6 | | | | | |
| TC | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X5R (R6) | | |
| Rated Volt. | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | |
| 2200pF (222) | 0.5 (5) | | | | | | | | | | | | | | | | | |
| 3300pF (332) | 0.5 (5) | | | | | | | | | | | | | | | | | |
| 4700pF (472) | 0.5 (5) | | | | | | 0.6 (6) | | | | | | | | | | | |
| 6800pF (682) | | 0.5 (5) | | | | | 0.6 (6) | | | | | | | | | | | |
| 10000pF (103) | | 0.5 (5) | 0.5 (5) | | | | 0.6 (6) | | | | | | 0.7 (7) | | | | | |
| 15000pF (153) | | 0.5 (5) | 0.5 (5) | | | | 0.6 (6) | | | | | | 0.7 (7) | 0.7 (7) | | | | |
| 22000pF (223) | | 0.5 (5) | 0.5 (5) | | | | 0.6 (6) | 0.6 (6) | | | | | 0.7 (7) | 0.7 (7) | | | | |
| 33000pF (333) | | | 0.5 (5) | | | | 0.85 (9) | 0.6 (6) | 0.6 (6) | | | | 0.7 (7) | 0.7 (7) | | | | |
| 47000pF (473) | | | 0.5 (5) | | | | | 0.6 (6) | 0.6 (6) | | | | 0.7 (7) | 0.7 (7) | | | | |
| 68000pF (683) | | | 0.5 (5) | | | | | 0.6 (6) | 0.6 (6) | | | | 0.7 (7) | 0.7 (7) | | | | |
| 0.10µF (104) | | | | 0.5 (5) | | | | 0.6 (6) | 0.6 (6) | | | | 1.15 (M) | 0.7 (7) | | | | |
| 0.15µF (154) | | | | | 0.5 (5) | | | 0.85 (9) | 0.6 (6) | | | | 1.15 (M) | 0.7 (7) | | | | |
| 0.22µF (224) | | | | | 0.5 (5) | | | | | 0.6 (6) | | | | 1.15 (M) | | | | |
| 0.33µF (334) | | | | | | 0.5 (5) | | | | 0.6 (6) | | | | 1.15 (M) | 0.7 (7) | | | |
| 0.47µF (474) | | | | | | 0.5 (5) | | | 0.85 (9) | | | | | 1.15 (M) | 0.7 (7) | | | |

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| Part Number | LLL18 | | | | | | LLL21 | | | | | | LLL31 | | | | | |
|--|-------------|------------|------------|-------------|-------------|------------|-------------|------------|------------|-------------|-------------|-------------|-------------|------------|------------|-------------|-------------|-------------|
| L x W | 1.6x0.8 | | | | | | 2.0x1.25 | | | | | | 3.2x1.6 | | | | | |
| TC | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X5R (R6) | | |
| Rated Volt. | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | |
| 0.68μF (684) | | | | | | | | | | | | 0.85 (9) | | | | 1.15 (M) | 0.7 (7) | |
| 1.0μF (105) | | | | | | 0.5 (5) | | | | | | 0.85 (9) | | | | 1.15 (M) | 0.7 (7) | |
| 1.5μF (155) | | | | | | | | | | | | 0.85 (9) | | | | 1.15 (M) | 0.7 (7) | |
| 2.2μF (225) | | | | | | | | | | | | 0.85 (9) | | | | 1.15 (M) | 0.7 (7) | |
| 4.7μF (475) | | | | | | | | | | | | | | | | | 1.15 (M) | |
| 10μF (106) | | | | | | | | | | | | | | | | | | 1.25 (B) |

The part numbering code is shown in ().
 Dimensions are shown in mm and Rated Voltage in Vdc.

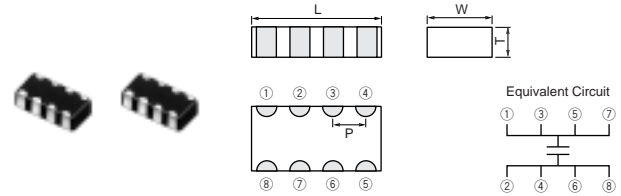
Reversed geometry Low ESL Type Low Profile

| Part Number | LLL18 | | | | LLL21 | | | | | | LLL31 | | | |
|--|-------------|------------|-------------|-----------|-------------|------------|------------|-------------|-------------|-----------|-------------|------------|------------|------------|
| L x W | 1.6x0.8 | | | | 2.0x1.25 | | | | | | 3.2x1.6 | | | |
| TC | X7R (R7) | | X7S (C7) | | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 10 (1A) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | |
| 680pF(681) | | | | | 0.5(5) | | | | | | | | | |
| 1000pF(102) | | | | | 0.5(5) | | | | | | | | | |
| 1500pF(152) | | | | | 0.5(5) | | | | | | | | | |
| 2200pF(222) | | | | | 0.5(5) | | | | | | | | | |
| 3300pF(332) | | | | | 0.5(5) | | | | | | | | | |
| 4700pF(472) | | | | | 0.5(5) | | | | | | | | | |
| 6800pF(682) | | | | | 0.5(5) | | | | | | | | | |
| 10000pF(103) | 0.5(5) | 0.5(5) | | | 0.5(5) | 0.5(5) | | | | | 0.5(5) | | | |
| 15000pF(153) | 0.5(5) | 0.5(5) | | | 0.5(5) | 0.5(5) | | | | | 0.5(5) | 0.5(5) | | |
| 22000pF(223) | | 0.5(5) | | | | 0.5(5) | 0.5(5) | | | | 0.5(5) | 0.5(5) | | |
| 33000pF(333) | | 0.5(5) | | | | 0.5(5) | 0.5(5) | | | | 0.5(5) | 0.5(5) | | |
| 47000pF(473) | | 0.5(5) | | | | | 0.5(5) | | | | | 0.5(5) | 0.5(5) | |
| 68000pF(683) | | | 0.5(5) | | | | 0.5(5) | | | | | 0.5(5) | 0.5(5) | |
| 0.10μF(104) | | | 0.5(5) | | | | 0.5(5) | | | | | 0.5(5) | 0.5(5) | |
| 0.15μF(154) | | | | | | | | 0.5(5) | | | | | | 0.5(5) |
| 0.22μF(224) | | | | 0.5(5) | | | | 0.5(5) | | | | | | 0.5(5) |
| 0.33μF(334) | | | | 0.5(5) | | | | 0.5(5) | | | | | | 0.5(5) |
| 0.47μF(474) | | | | | | | | | 0.5(5) | | | | | 0.5(5) |
| 0.68μF(684) | | | | | | | | | | | | | | 0.5(5) |
| 1.0μF(105) | | | | | | | | | | 0.5(5) | | | | |

The part numbering code is shown in ().
 Dimensions are shown in mm and Rated Voltage in Vdc.

■ Features (Eight Terminals Low ESL Type)

1. Low ESL (100pH) , suitable to decoupling capacitor for 1GHz clock speed IC.
2. Small, large cap



■ APPLICATIONS

1. High speed micro processor
2. High frequency digital equipment.

| Part Number | Dimensions (mm) | | | |
|---------------|-----------------|-----------|----------------|-----------|
| | L | W | T | P |
| LLA185 | 1.6 ±0.1 | 0.8 ±0.1 | 0.5 +0.05/-0.1 | 0.4 ±0.1 |
| LLA215 | 2.0 ±0.1 | 1.25 ±0.1 | 0.5 +0.05/-0.1 | 0.5 ±0.05 |
| LLA219 | 2.0 ±0.1 | 1.25 ±0.1 | 0.85 ±0.1 | 0.5 ±0.05 |
| LLA315 | 3.2 ±0.15 | 1.6 ±0.15 | 0.5 +0.05/-0.1 | 0.8 ±0.1 |
| LLA319 | 3.2 ±0.15 | 1.6 ±0.15 | 0.85 ±0.1 | 0.8 ±0.1 |
| LLA31M | 3.2 ±0.15 | 1.6 ±0.15 | 1.15 ±0.1 | 0.8 ±0.1 |

Eight Terminals Low ESL Type

| Part Number | LLA18 | | LLA21 | | | | LLA31 | | |
|--|-------------|--|-------------|---------|------------|---------|-------------|---------|-------------|
| L x W | 1.6x0.8 | | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7S (C7) | | X7R (R7) | | | | X7S (C7) | | |
| Rated Volt. | 4 (0G) | | 25 (1E) | | 16 (1C) | | 10 (1A) | | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | |
| 10000pF(103) | | | 0.85(9) | | | | | | |
| 15000pF(153) | | | 0.85(9) | | | | | | |
| 22000pF(223) | | | 0.85(9) | | | | | | |
| 33000pF(333) | | | 0.85(9) | | | | | | |
| 47000pF(473) | | | 0.85(9) | | | | | | |
| 68000pF(683) | | | | 0.85(9) | | | | | |
| 0.10µF(104) | | | | 0.85(9) | | | 0.85(9) | | |
| 0.15µF(154) | | | | 0.85(9) | | | 1.15(M) | | |
| 0.22µF(224) | | | | 0.85(9) | | | 0.85(9) | | |
| 0.33µF(334) | 0.5(5) | | | 0.85(9) | | | 0.85(9) | | |
| 0.47µF(474) | 0.5(5) | | | 0.85(9) | | | 0.85(9) | | |
| 0.68µF(684) | | | | 0.85(9) | | | 0.85(9) | | |
| 1.0µF(105) | 0.5(5) | | | | 0.85(9) | | | 0.85(9) | |
| 1.5µF(155) | | | | | 0.85(9) | | | 0.85(9) | |
| 2.2µF(225) | | | | | | 0.85(9) | | | 0.85(9) |
| 4.7µF(475) | | | | | | 0.85(9) | | | |


The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

Eight Terminals Low ESL Type Low Profile

| Part Number | LLA21 | | | | | LLA31 | | | |
|--|-------------|--------|------------|--------|-------------|-------------|--------|-----------|--|
| L x W | 2.0x1.25 | | | | | 3.2x1.6 | | | |
| TC | X7R (R7) | | | | X7S (C7) | X7R (R7) | | | |
| Rated Volt. | 25 (1E) | | 16 (1C) | | 10 (1A) | 6.3 (0J) | | 4 (0G) | |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | |
| 10000pF(103) | 0.5(5) | | | | | | | | |
| 15000pF(153) | 0.5(5) | | | | | | | | |
| 22000pF(223) | 0.5(5) | | | | | | | | |
| 33000pF(333) | | 0.5(5) | | | | | | | |
| 47000pF(473) | | 0.5(5) | | | | | | | |
| 68000pF(683) | | 0.5(5) | | | | | | | |
| 0.10µF(104) | | 0.5(5) | | | | | 0.5(5) | | |
| 0.15µF(154) | | | 0.5(5) | 0.5(5) | | | 0.5(5) | | |
| 0.22µF(224) | | | 0.5(5) | 0.5(5) | | | 0.5(5) | | |

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| Part Number | LLA21 | | | | | LLA31 | | |
|--|-------------|------------|------------|-------------|-------------|-------------|------------|-------------|
| L x W | 2.0x1.25 | | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | | | X7S (C7) | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 0.33μF(334) | | | 0.5(5) | 0.5(5) | | | 0.5(5) | |
| 0.47μF(474) | | | | 0.5(5) | | | 0.5(5) | |
| 0.68μF(684) | | | | 0.5(5) | | | 0.5(5) | |
| 1.0μF(105) | | | | | 0.5(5) | | | 0.5(5) |
| 1.5μF(155) | | | | | 0.5(5) | | | 0.5(5) |
| 2.2μF(225) | | | | | 0.5(5) | | | 0.5(5) |

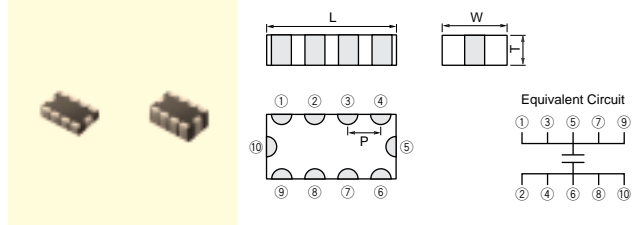
The part numbering code is shown in ().
 Dimensions are shown in mm and Rated Voltage in Vdc.

■ Features (Ten Terminals Low ESL Type)

1. Low ESL (45pH), suitable to decoupling capacitor for 2GHz clock speed IC.
2. Small, large cap

■ APPLICATIONS

1. High speed micro processor
2. High frequency digital equipment



| Part Number | Dimensions (mm) | | | |
|---------------|-----------------|-----------|----------------|-----------|
| | L | W | T | P |
| LLM215 | 2.0 ±0.1 | 1.25 ±0.1 | 0.5 +0.05/-0.1 | 0.5 ±0.05 |
| LLM219 | 2.0 ±0.1 | 1.25 ±0.1 | 0.85 ±0.1 | 0.5 ±0.05 |
| LLM315 | 3.2 ±0.15 | 1.6 ±0.15 | 0.5 +0.05/-0.1 | 0.8 ±0.1 |
| LLM31M | 3.2 ±0.15 | 1.6 ±0.15 | 1.15 ±0.1 | 0.8 ±0.1 |

Ten Terminals Low ESL Type

| Part Number | LLM21 | | | | LLM31 | | |
|--|-------------|------------|-------------|-----------|-------------|------------|-------------|
| | L x W | | | | | | |
| | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | X7S (C7) | | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 10000pF(103) | 0.85(9) | | | | | | |
| 15000pF(153) | 0.85(9) | | | | | | |
| 22000pF(223) | 0.85(9) | | | | | | |
| 33000pF(333) | 0.85(9) | | | | | | |
| 47000pF(473) | 0.85(9) | | | | | | |
| 68000pF(683) | | 0.85(9) | | | | | |
| 0.10μF(104) | | 0.85(9) | | | 1.15(M) | | |
| 0.15μF(154) | | 0.85(9) | | | 1.15(M) | | |
| 0.22μF(224) | | 0.85(9) | | | 1.15(M) | | |
| 0.33μF(334) | | | 0.85(9) | | 1.15(M) | | |
| 0.47μF(474) | | | 0.85(9) | | 1.15(M) | | |
| 0.68μF(684) | | | 0.85(9) | | 1.15(M) | | |
| 1.0μF(105) | | | 0.85(9) | | 1.15(M) | | |
| 1.5μF(155) | | | 0.85(9) | | | 1.15(M) | |
| 2.2μF(225) | | | | 0.85(9) | | 1.15(M) | |
| 3.3μF(335) | | | | | | | 1.15(M) |
| 4.7μF(475) | | | | | | | 1.15(M) |

The part numbering code is shown in ().
 Dimensions are shown in mm and Rated Voltage in Vdc.

Ten Terminals Low ESL Type Low Profile

| Part Number | LLM21 | | | | LLM31 | | |
|--|-------------|------------|-------------|-----------|-------------|------------|-------------|
| | L x W | | | | | | |
| | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | X7S (C7) | | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 10000pF(103) | 0.5(5) | | | | | | |
| 15000pF(153) | 0.5(5) | | | | | | |
| 22000pF(223) | 0.5(5) | | | | | | |
| 33000pF(333) | | 0.5(5) | | | | | |
| 47000pF(473) | | 0.5(5) | | | | | |
| 68000pF(683) | | 0.5(5) | | | | | |
| 0.10μF(104) | | 0.5(5) | | | 0.5(5) | | |
| 0.15μF(154) | | | 0.5(5) | | 0.5(5) | | |

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| Part Number | LLM21 | | | | LLM31 | | |
|--|-------------|------------|-------------|-------------|-------------|------------|-------------|
| L x W | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | | X7S (C7) | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 0.22μF(224) | | | 0.5(5) | | 0.5(5) | | |
| 0.33μF(334) | | | 0.5(5) | | | 0.5(5) | |
| 0.47μF(474) | | | 0.5(5) | | | 0.5(5) | |
| 0.68μF(684) | | | 0.5(5) | | | 0.5(5) | |
| 1.0μF(105) | | | | 0.5(5) | | | |
| 1.5μF(155) | | | | 0.5(5) | | | |
| 2.2μF(225) | | | | 0.5(5) | | | 0.5(5) |

The part numbering code is shown in ().
 Dimensions are shown in mm and Rated Voltage in Vdc.

Specifications and Test Methods

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------|---|--|--|------------------|-----------------|------------|-------------------|------------|-------------|--------------------|----------|-------------|--------|-------------|-------------|-------------|------|-------------|--|------|------------------|---|------|---|-------|---|------|---|-------|---|------|
| 1 | Operating Temperature Range | R6 : -55 to +85°C R7, C7 : -55 to +125°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Rated Voltage | See the previous pages. | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, should be maintained within the rated voltage range. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Appearance | No defects or abnormalities | Visual inspection | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Dimensions | Within the specified dimension | Using calipers | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Dielectric Strength | No defects or abnormalities | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Insulation Resistance | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>C≤10μF (10V min.)</td> <td>1±0.1kHz</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td>C≤10μF (6.3V max.)</td> <td>1±0.1kHz</td> <td>0.5±0.1Vrms</td> </tr> <tr> <td>C>10μF</td> <td>120±24kHz</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table> | Capacitance | Frequency | Voltage | C≤10μF (10V min.) | 1±0.1kHz | 1.0±0.2Vrms | C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | C>10μF | 120±24kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | |
| | | | Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (10V min.) | 1±0.1kHz | 1.0±0.2Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C>10μF | 120±24kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | <table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range (°C)</th> <th>Reference Temp.</th> <th>Cap.Change</th> </tr> </thead> <tbody> <tr> <td>R6</td> <td>-55 to +85</td> <td>25°C</td> <td>Within ±15%</td> </tr> <tr> <td>R7</td> <td>-55 to +125</td> <td>25°C</td> <td>Within ±15%</td> </tr> <tr> <td>C7</td> <td>-55 to +125</td> <td>25°C</td> <td>Within ±22%</td> </tr> </tbody> </table> | Char. | Temp. Range (°C) | Reference Temp. | Cap.Change | R6 | -55 to +85 | 25°C | Within ±15% | R7 | -55 to +125 | 25°C | Within ±15% | C7 | -55 to +125 | 25°C | Within ±22% | <p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</p> | Step | Temperature (°C) | 1 | 25±2 | 2 | -55±3 | 3 | 25±2 | 4 | 125±3 | 5 | 25±2 |
| Char. | Temp. Range (°C) | Reference Temp. | Cap.Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R6 | -55 to +85 | 25°C | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R7 | -55 to +125 | 25°C | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C7 | -55 to +125 | 25°C | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temperature (°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | -55±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 125±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Adhesive Strength of Termination | No removal of the terminations or other defect should occur. | Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 5N force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | D.F. | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±7.5% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | D.F. | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No failure | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 48±4 hours, then measure.</p> <ul style="list-style-type: none"> Initial measurement. <p>Perform a heat treatment at 150±9.0°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Continued on the following page. 

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | |
|------|---|---------------------|---|---|------------|------------------------------|------------|---|------------|------------------------------|------------|------------------------------|------------|-------------|------|--------|------|--------|
| 14 | Temperature Cycle | Appearance | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 48±4 hours at room temperature, then measure. <table border="1" style="margin: 10px 0;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. ± 3</td> <td>Room Temp.</td> <td>Max. Operating Temp. ± 3</td> <td>Room Temp.</td> </tr> <tr> <td>Time (min.)</td> <td>30±3</td> <td>2 to 3</td> <td>30±3</td> <td>2 to 3</td> </tr> </tbody> </table> | Step | 1 | 2 | 3 | 4 | Temp. (°C) | Min. Operating Temp. ± 3 | Room Temp. | Max. Operating Temp. ± 3 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
| | | Step | | 1 | 2 | 3 | 4 | | | | | | | | | | | |
| | | Temp. (°C) | | Min. Operating Temp. ± 3 | Room Temp. | Max. Operating Temp. ± 3 | Room Temp. | | | | | | | | | | | |
| | | Time (min.) | | 30±3 | 2 to 3 | 30±3 | 2 to 3 | | | | | | | | | | | |
| | | Capacitance Change | | Within ±7.5% *1 | | | | | | | | | | | | | | |
| D.F. | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | | | | | | | | | | | | | | | | | |
| I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | |
| | Dielectric Strength | No failure | | | | | | | | | | | | | | | | |
| 15 | Humidity (Steady State) | Appearance | Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. | | | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±12.5% *1 | | | | | | | | | | | | | | |
| | | D.F. | | 0.05 max. *1 | | | | | | | | | | | | | | |
| | | I.R. | | More than 1,000MΩ or 50Ω · F (Whichever is smaller) | | | | | | | | | | | | | | |
| 16 | Humidity Load | Appearance | Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA. | | | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±12.5% *1 | | | | | | | | | | | | | | |
| | | D.F. | | 0.05 max. *1 | | | | | | | | | | | | | | |
| | | I.R. | | More than 500MΩ or 25Ω · F *1 (Whichever is smaller) | | | | | | | | | | | | | | |
| | | Dielectric Strength | | No failure | | | | | | | | | | | | | | |
| 17 | High Temperature Load | Appearance | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA. <p>•Initial measurement. Apply 200% (*2) of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement. (*1)</p> | | | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±12.5% *1 | | | | | | | | | | | | | | |
| | | D.F. | | W.V.: 25V min.; 0.04 max. W.V.: 16V max.; 0.05 max. *1 | | | | | | | | | | | | | | |
| | | I.R. | | More than 1,000MΩ or 50Ω · F *1 (Whichever is smaller) | | | | | | | | | | | | | | |
| | | Dielectric Strength | | No failure | | | | | | | | | | | | | | |

*1 : The figure Indicates typical inspection. Please refer to individual specifications.

*2 : Some of the parts are applicable in rated voltage×150%. Please refer to individual specifications.