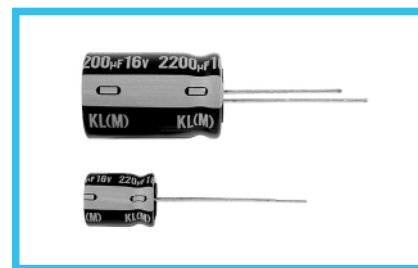


**KL** Low Leakage Current series



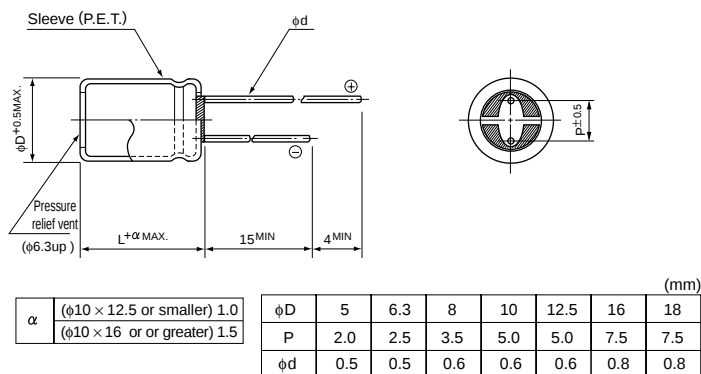
- Standard low leakage current series.
- Compliant to the RoHS directive (2011/65/EU).



## Specifications

| Item                                                                        | Performance Characteristics                                                                                                                                                                                                            |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------------------------------------------------|--|-------------------------------------------------------------------|--|--|--|--|--|--|--|
| Category Temperature Range                                                  | -40 to +85°C (※ -40 to +105°C product is also available upon request, but product rated at up to 50V less than or equal to φ10 × 12.5 Lmm)                                                                                             |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| Rated Voltage Range                                                         | 6.3 to 100V                                                                                                                                                                                                                            |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| Rated Capacitance Range                                                     | 0.1 to 10000μF                                                                                                                                                                                                                         |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| Capacitance Tolerance                                                       | ±20% (M), ±10% (K) at 120Hz 20°C                                                                                                                                                                                                       |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| Leakage Current                                                             | After 1 minute's (for case size 10 × 12.5 or smaller) or 2 minutes' (for case size 10 × 16 or larger) application of rated voltage, leakage current is not more than 0.002CV or 0.2 (μA) whichever is greater.                         |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| Tangent of loss angle (tan δ)                                               | Rated voltage (V)                                                                                                                                                                                                                      |                      | 6.3   | 10    | 16    | 25    | 35    | 50    | 63    | 100   | 120Hz, 20°C                                                        |  |                                                                   |  |  |  |  |  |  |  |
|                                                                             | tan δ (MAX.)                                                                                                                                                                                                                           | Less than φ10 × 12.5 | 0.18  | 0.15  | 0.12  | 0.08  | 0.08  | 0.08  | 0.07  | 0.07  |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
|                                                                             |                                                                                                                                                                                                                                        | φ10 × 16 or more     | 0.21  | 0.17  | 0.14  | 0.12  | 0.12  | 0.10  | 0.08  | 0.08  |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| For capacitance of more than 1000μF, add 0.02 for every increase of 1000μF. |                                                                                                                                                                                                                                        |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| stability at Low Temperature                                                | Rated voltage (V)                                                                                                                                                                                                                      |                      | 6.3   | 10    | 16    | 25    | 35    | 50    | 63    | 100   | 120Hz<br>Values in ( ) applicable to φ10 × 16 or larger case size. |  |                                                                   |  |  |  |  |  |  |  |
|                                                                             | Impedance ratio<br>ZT / Z20 (MAX.)                                                                                                                                                                                                     | Z-25°C / Z+20°C      | 3 (4) | 2 (3) | 2     | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
|                                                                             |                                                                                                                                                                                                                                        | Z-40°C / Z+20°C      | 5 (8) | 4 (6) | 3 (4) | 2 (4) | 2 (3) | 2 (3) | 2 (3) | 2 (3) |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
| Endurance                                                                   | The specifications listed at right shall be met when the capacitors are restored to 20°C after the rated voltage is applied for 2000 hours at 85°C, or 1000 hours at 105°C.                                                            |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
|                                                                             |                                                                                                                                                                                                                                        |                      |       |       |       |       |       |       |       |       | Capacitance change                                                 |  | Within ±15% of the initial capacitance value (6.3V : Within ±20%) |  |  |  |  |  |  |  |
|                                                                             |                                                                                                                                                                                                                                        |                      |       |       |       |       |       |       |       |       | tan δ                                                              |  | 150% or less than the initial specified value                     |  |  |  |  |  |  |  |
| Shelf Life                                                                  | After storing the capacitors under no load at 85°C for 1000 hours and then performing voltage treatment based on JIS C 5101-4 clause 4.1 at 20°C, they shall meet the specified values for the endurance characteristics listed above. |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |
|                                                                             |                                                                                                                                                                                                                                        |                      |       |       |       |       |       |       |       |       | Leakage current                                                    |  | Less than or equal to the initial specified value                 |  |  |  |  |  |  |  |
| Marking                                                                     | Printed with white color letter on black sleeve.                                                                                                                                                                                       |                      |       |       |       |       |       |       |       |       |                                                                    |  |                                                                   |  |  |  |  |  |  |  |

## Radial Lead Type



• Please refer to page 20 about the end seal configuration.

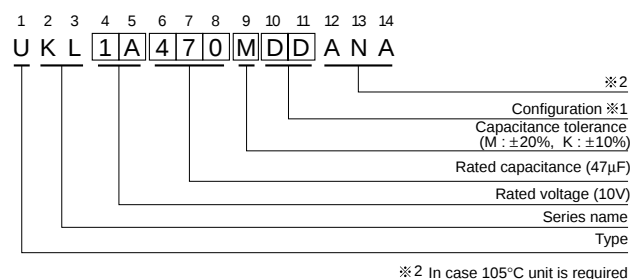
## Frequency coefficient of rated ripple current

| Cap.(µF)      | Frequency | 50Hz | 120Hz | 300Hz | 1kHz | 10kHz or more |
|---------------|-----------|------|-------|-------|------|---------------|
| 0.1 to 68     |           | 0.75 | 1.00  | 1.35  | 1.57 | 2.00          |
| 100 to 680    |           | 0.80 | 1.00  | 1.23  | 1.34 | 1.50          |
| 1000 to 10000 |           | 0.85 | 1.00  | 1.10  | 1.13 | 1.15          |

Please refer to page 20, 21, 22 about the formed or taped product spec.  
Please refer to page 4 for the minimum order quantity.

• Dimension table in next page.

## Type numbering system (Example : 10V 47µF)



| $\phi D$   | Pb-free leadwire<br>Pb-free PET sleeve |
|------------|----------------------------------------|
| 5          | DD                                     |
| 6.3        | ED                                     |
| 8 · 10     | PD                                     |
| 12.5 to 18 | HD                                     |

KL series

## ■ Dimensions

| V        |      | 6.3       |      | 10        |      | 16        |      | 25        |      |
|----------|------|-----------|------|-----------|------|-----------|------|-----------|------|
| Cap.(μF) | Code | 0J        |      | 1A        |      | 1C        |      | 1E        |      |
| 4.7      | 4R7  |           |      |           |      |           |      | 5 × 11    | 45   |
| 6.8      | 6R8  |           |      |           |      |           |      | 5 × 11    | 55   |
| 10       | 100  |           |      |           |      | 5 × 11    | 55   | 5 × 11    | 70   |
| 15       | 150  |           |      |           |      | 5 × 11    | 70   | 5 × 11    | 85   |
| 22       | 220  |           |      |           |      | 5 × 11    | 85   | 5 × 11    | 100  |
| 33       | 330  |           |      |           |      | 5 × 11    | 100  | 6.3 × 11  | 140  |
| 47       | 470  |           |      | 5 × 11    | 110  | 6.3 × 11  | 140  | 6.3 × 11  | 170  |
| 68       | 680  |           |      | 6.3 × 11  | 150  | 6.3 × 11  | 160  | 8 × 11.5  | 230  |
| 100      | 101  |           |      | 6.3 × 11  | 180  | 8 × 11.5  | 230  | 8 × 11.5  | 280  |
| 150      | 151  |           |      | 8 × 11.5  | 250  | 8 × 11.5  | 280  | 10 × 12.5 | 370  |
| 220      | 221  |           |      | 8 × 11.5  | 310  | 10 × 12.5 | 370  | 10 × 16   | 400  |
| 330      | 331  |           |      | 10 × 12.5 | 400  | 10 × 16   | 420  | 10 × 20   | 490  |
| 470      | 471  | 10 × 12.5 | 390  | 10 × 16   | 530  | 10 × 20   | 550  | 12.5 × 20 | 660  |
| 680      | 681  | 10 × 16   | 480  | 10 × 20   | 600  | 12.5 × 20 | 730  | 12.5 × 25 | 810  |
| 1000     | 102  | 10 × 20   | 650  | 12.5 × 20 | 810  | 12.5 × 25 | 910  | 16 × 25   | 1010 |
| 1500     | 152  | 12.5 × 25 | 910  | 12.5 × 25 | 1020 | 16 × 25   | 1150 | 16 × 31.5 | 1270 |
| 2200     | 222  | 12.5 × 25 | 1060 | 16 × 25   | 1200 | 16 × 25   | 1300 | 16 × 35.5 | 1440 |
| 3300     | 332  | 16 × 25   | 1270 | 16 × 31.5 | 1420 | 16 × 35.5 | 1550 | 18 × 40   | 1720 |
| 4700     | 472  | 16 × 31.5 | 1500 | 16 × 35.5 | 1650 | 18 × 35.5 | 1820 |           |      |
| 6800     | 682  | 18 × 35.5 | 1760 | 18 × 35.5 | 1890 |           |      |           |      |
| 10000    | 103  | 18 × 40   | 1900 |           |      |           |      |           |      |

| V        |      | 35        |      | 50        |      | 63        |      | 100                       |                 |
|----------|------|-----------|------|-----------|------|-----------|------|---------------------------|-----------------|
| Cap.(μF) | Code | 1V        |      | 1H        |      | 1J        |      | 2A                        |                 |
| 0.1      | 0R1  |           |      | 5 × 11    | 1.1  |           |      | 5 × 11                    | 2.1             |
| 0.15     | R15  |           |      | 5 × 11    | 1.6  |           |      | 5 × 11                    | 3.2             |
| 0.22     | R22  |           |      | 5 × 11    | 2.3  |           |      | 5 × 11                    | 4.7             |
| 0.33     | R33  |           |      | 5 × 11    | 3.5  |           |      | 5 × 11                    | 7.0             |
| 0.47     | R47  |           |      | 5 × 11    | 5.0  |           |      | 5 × 11                    | 10.1            |
| 0.68     | R68  |           |      | 5 × 11    | 7.3  |           |      | 5 × 11                    | 14.5            |
| 1        | 010  |           |      | 5 × 11    | 10.7 |           |      | 5 × 11                    | 19              |
| 1.5      | 1R5  |           |      | 5 × 11    | 16   |           |      | 5 × 11                    | 23              |
| 2.2      | 2R2  |           |      | 5 × 11    | 23   |           |      | 5 × 11                    | 28              |
| 3.3      | 3R3  |           |      | 5 × 11    | 40   |           |      | 5 × 11                    | 45              |
| 4.7      | 4R7  |           |      | 5 × 11    | 45   |           |      | 5 × 11                    | 50              |
| 6.8      | 6R8  |           |      | 5 × 11    | 55   | 5 × 11    | 59   | 6.3 × 11                  | 65              |
| 10       | 100  |           |      | 5 × 11    | 70   | 6.3 × 11  | 75   | 8 × 11.5                  | 90              |
| 15       | 150  | 5 × 11    | 85   | 6.3 × 11  | 95   | 6.3 × 11  | 100  | 8 × 11.5                  | 110             |
| 22       | 220  | 6.3 × 11  | 110  | 6.3 × 11  | 110  | 8 × 11.5  | 115  | 10 × 12.5                 | 136             |
| 33       | 330  | 6.3 × 11  | 140  | 8 × 11.5  | 165  | 8 × 11.5  | 170  | 10 × 16                   | 180             |
| 47       | 470  | 8 × 11.5  | 190  | 8 × 11.5  | 190  | 10 × 12.5 | 200  | 10 × 20                   | 220             |
| 68       | 680  | 8 × 11.5  | 230  | 10 × 12.5 | 250  | 10 × 16   | 270  | 10 × 20                   | 290             |
| 100      | 101  | 10 × 12.5 | 300  | 10 × 16   | 320  | 10 × 20   | 330  | 12.5 × 20                 | 370             |
| 150      | 151  | 10 × 16   | 400  | 10 × 20   | 420  | 12.5 × 20 | 450  | 12.5 × 25                 | 470             |
| 220      | 221  | 10 × 20   | 440  | 12.5 × 20 | 490  | 12.5 × 20 | 550  | 16 × 25                   | 580             |
| 330      | 331  | 12.5 × 20 | 550  | 12.5 × 20 | 600  | 12.5 × 25 | 710  | 16 × 31.5                 | 730             |
| 470      | 471  | 12.5 × 25 | 680  | 16 × 25   | 760  | 16 × 25   | 850  | 18 × 35.5                 | 910             |
| 680      | 681  | 16 × 25   | 840  | 16 × 25   | 910  | 16 × 31.5 | 1050 |                           |                 |
| 1000     | 102  | 16 × 25   | 1100 | 16 × 31.5 | 1140 | 18 × 35.5 | 1330 |                           |                 |
| 1500     | 152  | 16 × 35.5 | 1390 | 18 × 40   | 1480 |           |      | Case size<br>φ D × L (mm) | Rated<br>ripple |
| 2200     | 222  | 18 × 35.5 | 1580 |           |      |           |      |                           |                 |

Rated ripple current (mA rms) at 85°C 120Hz

Rated ripple current (mA rms) of 105°C product : 70 percent value of rated ripple of 85°C product at 105°C 120Hz