

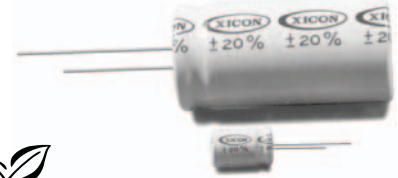


# Miniature Aluminum Electrolytic Capacitors

## XRL Series

### FEATURES

- Low impedance characteristics
- Case sizes are smaller than conventional general-purpose capacitors, with very high performance
- Can size larger than 9mm diameter has safety vents on rubber end seal
- RoHS Compliant



### CHARACTERISTICS

| Item                                                    | Characteristics                                                                                                                                                                                                                                              |                                                                                                                                                                          |      |      |      |      |      |      |      |      |      |      |      |    |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|----|
| Operating Temperature Range                             | -40°C ~ +85°C                                                                                                                                                                                                                                                |                                                                                                                                                                          |      |      |      |      |      |      |      |      |      |      |      |    |
| Capacitance Tolerance                                   | ±20% at 120Hz, 20°C                                                                                                                                                                                                                                          |                                                                                                                                                                          |      |      |      |      |      |      |      |      |      |      |      |    |
| Leakage Current                                         | ≤100V                                                                                                                                                                                                                                                        | I = 0.01CWV or 3μA whichever is greater after 2 minutes of applied rated DC working voltage at 20°C<br>Where: C = rated capacitance in μF; WV = rated DC working voltage |      |      |      |      |      |      |      |      |      |      |      |    |
|                                                         | >100V                                                                                                                                                                                                                                                        | CWV ≤ 1000 μF: I= 0.03 CWV + 15uA; C= rated capacitance in uF<br>CWV ≥ 1000 μF: I= 0.02 CWV + 25uA; WV= rated DC working voltage in V                                    |      |      |      |      |      |      |      |      |      |      |      |    |
| Dissipation Factor<br>(Tan δ, at 20°C 120Hz)            | Working voltage (WV)                                                                                                                                                                                                                                         | 6.3                                                                                                                                                                      | 10   | 16   | 25   | 35   | 50   | 63   | 100  | 160  | 250  | 350  | 450  |    |
|                                                         | Tan δ                                                                                                                                                                                                                                                        | 0.23                                                                                                                                                                     | 0.20 | 0.16 | 0.14 | 0.12 | 0.10 | 0.09 | 0.08 | 0.12 | 0.17 | 0.20 | 0.25 |    |
|                                                         | For capacitors whose capacitance exceeds 1,000μF, the specification of tan δ is increased by 0.02 for every addition of 1,000μF                                                                                                                              |                                                                                                                                                                          |      |      |      |      |      |      |      |      |      |      |      |    |
| Surge Voltage                                           | Working voltage (WV)                                                                                                                                                                                                                                         | 6.3                                                                                                                                                                      | 10   | 16   | 25   | 35   | 50   | 63   | 100  | 160  | 250  | 350  | 450  |    |
|                                                         | Surge voltage (SV)                                                                                                                                                                                                                                           | 8                                                                                                                                                                        | 13   | 20   | 32   | 44   | 63   | 79   | 125  | 200  | 300  | 400  | 500  |    |
| Low Temperature Characteristics<br>(Imp. ratio @ 120Hz) | Working voltage (WV)                                                                                                                                                                                                                                         | 6.3                                                                                                                                                                      | 10   | 16   | 25   | 35   | 50   | 63   | 100  | 160  | 250  | 350  | 450  |    |
|                                                         | Z(-25°C)/Z(+20°C)                                                                                                                                                                                                                                            | øD<16                                                                                                                                                                    | 6    | 4    | 3    | 3    | 2    | 2    | 2    | 3    | 8    | 12   | 16   |    |
|                                                         |                                                                                                                                                                                                                                                              | øD≥16                                                                                                                                                                    | 8    | 6    | 4    | 4    | 3    | 3    | 3    | 3    | 8    | 12   | 16   |    |
|                                                         | Z(-40°C)/Z(+20°C)                                                                                                                                                                                                                                            | øD<16                                                                                                                                                                    | 10   | 8    | 6    | 6    | 4    | 3    | 3    | 3    | 4    | 10   | 16   | 20 |
|                                                         |                                                                                                                                                                                                                                                              | øD≥16                                                                                                                                                                    | 18   | 16   | 12   | 10   | 8    | 8    | 6    | 6    | 4    | 10   | 16   | 20 |
| Load Test                                               | When returned to +20°C after 2,000 hours application of working voltage at +85°C, the capacitor will meet the following limits: Capacitance change is ≤ ±20% of initial value; tan δ is < 200% of specified value; leakage current is within specified value |                                                                                                                                                                          |      |      |      |      |      |      |      |      |      |      |      |    |
| Shelf Life Test                                         | When returned to +20°C after 1,000 hours at +85°C with no voltage applied, the capacitor will meet the following limits: Capacitance change is ≤ ±20% of initial value; tan δ is < 200% of specified value; leakage current is within specified value        |                                                                                                                                                                          |      |      |      |      |      |      |      |      |      |      |      |    |

### PART NUMBERING SYSTEM

|        |   |   |   |        |   |   |                      |   |   |                               |   |   |                       |   |   |
|--------|---|---|---|--------|---|---|----------------------|---|---|-------------------------------|---|---|-----------------------|---|---|
| 1      | 4 | 0 | - | X      | R | L | 1                    | 6 | V | 1                             | 0 | 0 | -                     | R | C |
| Prefix |   |   |   | Series |   |   | Voltage Actual Value |   |   | Capacitance (μF) Actual Value |   |   | Suffix RoHS Compliant |   |   |

### RIPPLE CURRENT AND FREQUENCY MULTIPLIERS

| Capacitance (μF) | Frequency (Hz) |     |      |      |      |
|------------------|----------------|-----|------|------|------|
|                  | 60 (50)        | 120 | 500  | 1K   | ≥10K |
| <100             | 0.70           | 1.0 | 1.30 | 1.40 | 1.50 |
| 100 ~ 1000       | 0.75           | 1.0 | 1.20 | 1.30 | 1.35 |
| >1000            | 0.80           | 1.0 | 1.10 | 1.12 | 1.15 |

### RIPPLE CURRENT AND TEMPERATURE MULTIPLIERS

| Temperature (°C) | <50  | 70  | 85  |
|------------------|------|-----|-----|
| Multiplier       | 1.78 | 1.4 | 1.0 |



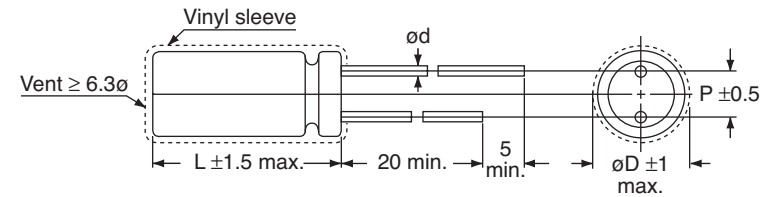
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Miniature Aluminum Electrolytic Capacitors

XRL Series

■ DIMENSIONS AND PERMISSIBLE RIPPLE CURRENT



Lead Spacing and Diameter (mm)

|    |     |     |     |     |     |     |     |     |      |
|----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| φD | 5   | 6.3 | 8   | 10  | 13  | 16  | 18  | 22  | 25   |
| P  | 2.0 | 2.5 | 3.5 | 5.0 | 5.0 | 7.5 | 7.5 | 10  | 12.5 |
| φd | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.8 | 0.8 | 1.0 | 1.0  |

Tape and box is 5.0mm lead space.

| Value<br>(μF) | Working Voltage (WV); Dimensions: φD x L (mm); Ripple Current: mA/RMS @ 120Hz, 85°C |      |           |      |           |      |          |      |          |      |          |      |          |      |
|---------------|-------------------------------------------------------------------------------------|------|-----------|------|-----------|------|----------|------|----------|------|----------|------|----------|------|
|               | 10                                                                                  |      | 16        |      | 25        |      | 35       |      | 50       |      | 63       |      | 100      |      |
|               | φD x L                                                                              | mA   | φD x L    | mA   | φD x L    | mA   | φD x L   | mA   | φD x L   | mA   | φD x L   | mA   | φD x L   | mA   |
| .10           |                                                                                     |      |           |      |           |      |          |      | 5 x 11   | 1.5  | 5 x 11   | 3.0  | 5 x 11   | 3.0  |
| .22           |                                                                                     |      |           |      |           |      |          |      | 5 x 11   | 3.5  | 5 x 11   | 4.5  | 5 x 11   | 5.8  |
| .33           |                                                                                     |      |           |      |           |      |          |      | 5 x 11   | 5.0  | 5 x 11   | 7.5  | 5 x 11   | 8.8  |
| .47           |                                                                                     |      |           |      | 5 x 11    | 6.0  |          |      | 5 x 11   | 7.0  | 5 x 11   | 9.5  | 5 x 11   | 12   |
| 1.0           |                                                                                     |      |           |      | 5 x 11    | 10   |          |      | 5 x 11   | 15   | 5 x 11   | 17   | 5 x 11   | 22   |
| 2.2           |                                                                                     |      | 5 x 11    | 20   | 5 x 11    | 16   |          |      | 5 x 11   | 29   | 5 x 11   | 28   | 5 x 11   | 33   |
| 3.3           |                                                                                     |      | 5 x 11    | 30   | 5 x 11    | 25   |          |      | 5 x 11   | 35   | 5 x 11   | 34   | 5 x 11   | 40   |
| 4.7           |                                                                                     |      | 5 x 11    | 41   | 5 x 11    | 31   | 5 x 11   | 40   | 5 x 11   | 42   | 5 x 11   | 45   | 5 x 11   | 48   |
| 10            | 5 x 11                                                                              | 54   | 5 x 11    | 49   | 5 x 11    | 54   | 5 x 11   | 58   | 5 x 11   | 65   | 5 x 11   | 70   | 6.3 x 11 | 80   |
| 22            | 5 x 11                                                                              | 70   | 5 x 11    | 75   | 5 x 11    | 80   | 5 x 11   | 87   | 5 x 11   | 95   | 6.3 x 11 | 115  | 8 x 11.5 | 135  |
| 33            | 5 x 11                                                                              | 84   | 5 x 11    | 90   | 5 x 11    | 97   | 6.3 x 11 | 115  | 6.3 x 11 | 136  | 8 x 11.5 | 150  | 10 x 16  | 195  |
| 47            | 5 x 11                                                                              | 100  | 5 x 11    | 110  | 5 x 11    | 115  | 6.3 x 11 | 145  | 6.3 x 11 | 165  | 8 x 11.5 | 190  | 10 x 16  | 255  |
| 100           | 5 x 11                                                                              | 145  | 6.3 x 11  | 180  | 6.3 x 11  | 190  | 8 x 11.5 | 240  | 8 x 11.5 | 260  | 10 x 12  | 320  | 10 x 20  | 370  |
| 220           | 6.3 x 11                                                                            | 250  | 8 x 11.5  | 300  | 8 x 11.5  | 320  | 10 x 12  | 420  | 10 x 16  | 490  | 10 x 20  | 565  | 13 x 25  | 675  |
| 330           | 8 x 11.5                                                                            | 350  | 8 x 11.5  | 370  | 10 x 12.5 | 470  | 10 x 16  | 570  | 13 x 20  | 635  | 13 x 20  | 765  | 16 x 32  | 972  |
| 470           | 8 x 11.5                                                                            | 415  | 10 x 12.5 | 520  | 10 x 16   | 620  | 10 x 16  | 740  | 13 x 20  | 860  | 16 x 25  | 1050 | 18 x 36  | 1135 |
| 1000          | 10 x 12.5                                                                           | 650  | 10 x 16   | 785  | 13 x 20   | 1090 | 13 x 20  | 1145 | 16 x 25  | 1530 | 16 x 25  | 1700 | 22 x 40  | 2600 |
| 2200          | 13 x 20                                                                             | 1240 | 13 x 20   | 1295 | 16 x 25   | 1660 | 16 x 32  | 1890 | 18 x 40  | 2231 | 18 x 40  | 2385 |          |      |
| 3300          | 13 x 20                                                                             | 1420 | 16 x 25   | 1840 | 16 x 32   | 2070 | 18 x 36  | 2430 | 22 x 40  | 2785 | 22x 40   | 3000 |          |      |
| 4700          | 16 x 25                                                                             | 1980 | 16 x 32   | 2260 | 18 x 36   | 2520 | 18 x 36  | 2700 | 25 x 40  | 3300 | 25 x 40  | 3560 |          |      |
| 6800          | 16 x 25                                                                             | 2220 | 16 x 32   | 2520 | 18 x 36   | 2880 | 22 x 41  | 2900 |          |      |          |      |          |      |
| 10000         | 18 x 36                                                                             | 2880 | 18 x 36   | 3080 | 22 x 40   | 3440 |          |      |          |      |          |      |          |      |

| Value<br>(μF) | Working Voltage (WV); Dimensions: φD x L (mm); Ripple Current: mA/RMS @ 120Hz, 85°C |      |           |      |          |     |           |     |
|---------------|-------------------------------------------------------------------------------------|------|-----------|------|----------|-----|-----------|-----|
|               | 160                                                                                 |      | 250       |      | 350      |     | 450       |     |
|               | φD x L                                                                              | mA   | φD x L    | mA   | φD x L   | mA  | φD x L    | mA  |
| .47           | 5 x 11                                                                              | 13   | 8 x 11.5  | 21   | 8 x 11.5 | 21  | 10 x 12.5 | 26  |
| 1.0           | 5 x 11                                                                              | 20   | 8 x 11.5  | 32   | 8 x 11.5 | 32  | 10 x 12.5 | 38  |
| 2.2           | 6.3 x 11                                                                            | 34   | 8 x 11.5  | 49   | 10 x 16  | 63  | 10 x 16   | 63  |
| 3.3           | 8 x 11.5                                                                            | 50   | 10 x 12.5 | 70   | 10 x 16  | 78  | 10 x 20   | 86  |
| 4.7           | 8 x 11.5                                                                            | 60   | 10 x 16   | 93   | 10 x 20  | 103 | 13 x 20   | 120 |
| 10            | 10 x 16                                                                             | 115  | 10 x 20   | 150  | 13 x 20  | 174 | 13 x 25   | 192 |
| 22            | 13 x 20                                                                             | 216  | 13 x 20   | 255  | 13 x 25  | 282 | 16 x 25   | 354 |
| 33            | 13 x 20                                                                             | 270  | 13 x 25   | 348  | 16 x 32  | 438 | 18 x 36   | 426 |
| 47            | 13 x 25                                                                             | 354  | 16 x 25   | 468  | 16 x 36  | 500 | 18 x 40   | 555 |
| 100           | 16 x 25                                                                             | 582  | 18 x 40   | 822  | 18 x 40  | 685 | 22 x 45   | 750 |
| 220           | 18 x 36                                                                             | 900  | 22 x 40   | 1134 |          |     |           |     |
| 330           | 18 x 40                                                                             | 1010 |           |      |          |     |           |     |

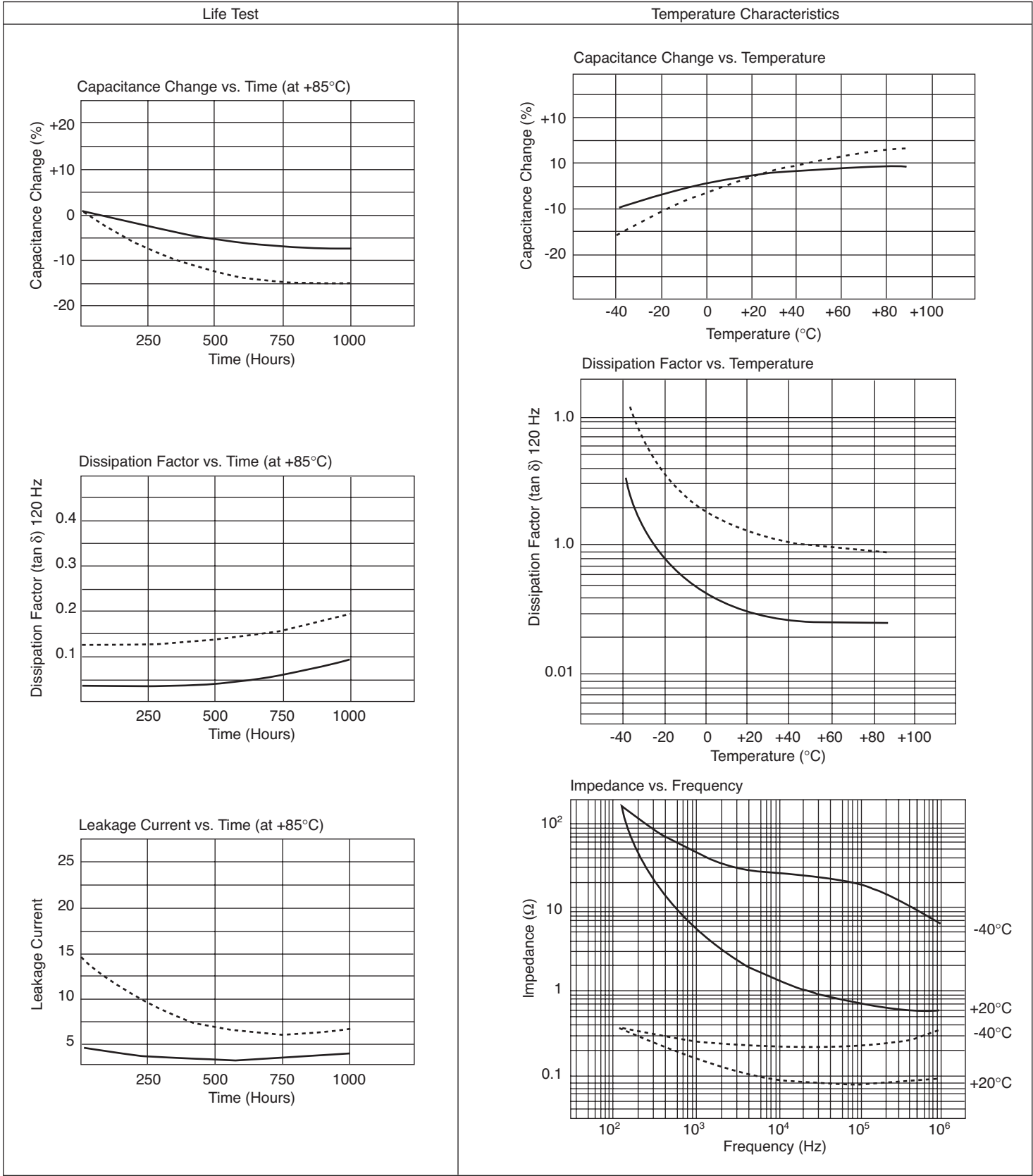


# Miniature Aluminum Electrolytic Capacitors

# XRL Series

## TYPICAL PERFORMANCE CHARACTERISTICS

----- 1000 $\mu$ F 16V  
————— 1 $\mu$ F 50V



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