

## RADIAL LEADS, POLARIZED, STANDARD CASE SIZING

**NRSA → NRSS**  
(today's standard) (reduced sizes)



## CHARACTERISTICS

|                                                      |              |                                     |                                           |      |      |      |      |      |      |      |
|------------------------------------------------------|--------------|-------------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
| Rated Voltage Range                                  |              | 6.3 ~ 100 VDC                       |                                           |      |      |      |      |      |      |      |
| Capacitance Range                                    |              | 0.47 ~ 10,000μF                     |                                           |      |      |      |      |      |      |      |
| Operating Temperature Range                          |              | -40 ~ +85°C                         |                                           |      |      |      |      |      |      |      |
| Capacitance Tolerance                                |              | ± 20% (M)                           |                                           |      |      |      |      |      |      |      |
| Max. Leakage Current @ (20°C)                        | After 1 min. | 0.03CV or 4μA, whichever is greater |                                           |      |      |      |      |      |      |      |
|                                                      | After 2 min. | 0.01CV or 3μA, whichever is greater |                                           |      |      |      |      |      |      |      |
| Max. Tan δ @ 120Hz/20°C                              |              | W.V. (Vdc)                          | 6.3                                       | 10   | 16   | 25   | 35   | 50   | 63   | 100  |
|                                                      |              | S.V. (Vdc)                          | 8                                         | 13   | 20   | 32   | 44   | 63   | 79   | 125  |
|                                                      |              | C ≤ 1,000μF                         | 0.24                                      | 0.20 | 0.16 | 0.14 | 0.12 | 0.10 | 0.10 | 0.10 |
|                                                      |              | C = 2,200μF                         | 0.24                                      | 0.21 | 0.18 | 0.16 | 0.14 | 0.12 | 0.11 |      |
|                                                      |              | C = 3,300μF                         | 0.26                                      | 0.23 | 0.20 | 0.18 | 0.16 | 0.14 | 0.13 |      |
|                                                      |              | C = 4,700μF                         | 0.28                                      | 0.25 | 0.22 | 0.20 | 0.18 | 0.20 |      |      |
|                                                      |              | C = 6,800μF                         | 0.32                                      | 0.29 | 0.26 | 0.24 |      |      |      |      |
|                                                      |              | C = 10,000μF                        | 0.40                                      | 0.37 | 0.34 | 0.32 |      |      |      |      |
| Low Temperature Stability<br>Impedance Ratio @ 120Hz |              | Z-25°C/Z+20°C                       | 4                                         | 3    | 2    | 2    | 2    | 2    | 2    | 2    |
|                                                      |              | Z-40°C/Z+20°C                       | 10                                        | 8    | 6    | 4    | 3    | 3    | 3    | 3    |
| Load Life Test at Rated W.V.<br>85°C 2,000 Hours     |              | Capacitance Change                  | Within ±20% of initial measured value     |      |      |      |      |      |      |      |
|                                                      |              | Tan δ                               | Less than 200% of specified maximum value |      |      |      |      |      |      |      |
|                                                      |              | Leakage Current                     | Less than specified maximum value         |      |      |      |      |      |      |      |
| Shelf Life Test<br>85°C 1,000 Hours<br>No Load       |              | Capacitance Change                  | Within ±20% of initial measured value     |      |      |      |      |      |      |      |
|                                                      |              | Tan δ                               | Less than 200% of specified maximum value |      |      |      |      |      |      |      |
|                                                      |              | Leakage Current                     | Less than specified maximum value         |      |      |      |      |      |      |      |

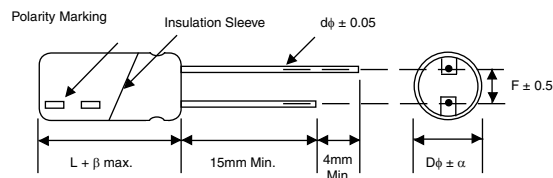
Note: Capacitors shall conform to JIS-C-5141, unless otherwise specified here.

## STANDARD PRODUCTS AND CASE SIZE TABLE: D φ x L (mm)

| Cap (μF) | Code | Working Voltage (WVDC) |           |           |           |           |           |           |           |
|----------|------|------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|          |      | 6.3                    | 10        | 16        | 25        | 35        | 50        | 63        | 100       |
| 0.47     | R47  | -                      | -         | -         | -         | -         | 5 x 11    | -         | 5 x 11    |
| 1.0      | 1R0  | -                      | -         | -         | -         | -         | 5 x 11    | -         | 5 x 11    |
| 2.2      | 2R2  | -                      | -         | -         | -         | -         | 5 x 11    | -         | 5 x 11    |
| 3.3      | 3R3  | -                      | -         | -         | -         | -         | 5 x 11    | -         | 5 x 11    |
| 4.7      | 4R7  | -                      | -         | -         | -         | -         | 5 x 11    | -         | 5 x 11    |
| 10       | 100  | -                      | -         | 5 x 11    | -         | 5 x 11    | 5 x 11    | 5 x 11    | 6.3 x 11  |
| 22       | 220  | -                      | -         | 5 x 11    | 5 x 11    | 5 x 11    | 5 x 11    | 6.3 x 11  | 8 x 11.5  |
| 33       | 330  | -                      | -         | 5 x 11    | 5 x 11    | 5 x 11    | 6.3 x 11  | 6.3 x 11  | 10 x 12.5 |
| 47       | 470  | -                      | 5 x 11    | 5 x 11    | 5 x 11    | 6.3 x 11  | 6.3 x 11  | 8 x 11.5  | 10 x 16   |
| 100      | 101  | -                      | 5 x 11    | 6.3 x 11  | 6.3 x 11  | 8 x 11.5  | 8 x 11.5  | 10 x 12.5 | 12.5 x 20 |
| 150      | 151  | -                      | 5 x 11    | 6.3 x 11  | 6.3 x 11  | 8 x 11.5  | 10 x 12.5 | 10 x 16   | 12.5 x 20 |
| 220      | 221  | -                      | 6.3 x 11  | 8 x 11.5  | 8 x 11.5  | 10 x 12.5 | 10 x 16   | 10 x 20   | 16 x 25   |
| 330      | 331  | 6.3 x 11               | 8 x 11.5  | 8 x 11.5  | 10 x 12.5 | 10 x 16   | 10 x 20   | 12.5 x 20 | 16 x 25   |
| 470      | 471  | 8 x 11.5               | 8 x 11.5  | 10 x 12.5 | 10 x 16   | 10 x 20   | 12.5 x 20 | 12.5 x 25 | 16 x 31   |
| 680      | 681  | 10x12.5                | -         | -         | -         | -         | -         | -         | -         |
| 1000     | 102  | 10 x 12.5              | 10 x 16   | 10 x 20   | 12.5 x 20 | 12.5 x 25 | 16 x 25   | 16 x 31   | -         |
| 1500     | 152  | 10 x 20                | 12.5 x 20 | 12.5 x 25 | 12.5 x 25 | 16 x 25   | 16 x 31   | 18 x 36   | -         |
| 2200     | 222  | 12.5 x 20              | 12.5 x 20 | 12.5 x 25 | 16 x 25   | 16 x 31   | 18 x 36   | 18 x 36   | -         |
| 3300     | 332  | 12.5 x 20              | 12.5 x 25 | 16 x 25   | 16 x 31   | 18 x 36   | 22 x 36   | 22 x 42   | -         |
| 4700     | 472  | 16 x 25                | 16 x 25   | 16 x 31   | 18 x 36   | 22 x 36   | 22 x 42   | -         | -         |
| 6800     | 682  | 16 x 25                | 16 x 31   | 18 x 36   | 22 x 36   | -         | -         | -         | -         |
| 10,000   | 103  | 16 x 31                | 18 x 36   | 22 x 36   | 22 x 36   | -         | -         | -         | -         |

### LEAD SPACING AND DIAMETER (mm)

| Case Dia. (D $\phi$ )  | 5   | 6.3 | 8   | 10  | 12.5 | 16  | 18  | 22  |
|------------------------|-----|-----|-----|-----|------|-----|-----|-----|
| Leads Dia. (d $\phi$ ) | 0.5 | 0.5 | 0.6 | 0.6 | 0.6  | 0.8 | 0.8 | 0.8 |
| Lead Spacing (F)       | 2.0 | 2.5 | 3.5 | 5.0 | 5.0  | 7.5 | 7.5 | 10  |
| Dim. $\alpha$          | 0.5 | 0.5 | 0.5 | 0.5 | 0.5  | 0.5 | 0.5 | 1.0 |



$\beta = L < 20\text{mm} = 1.5\text{mm}$ ,  $L > 20\text{mm} = 2.0\text{mm}$

SLEEVE COLOR: DARK

### PERMISSIBLE RIPPLE CURRENT (mA rms) AT 85°C AND 120Hz

| Cap ( $\mu\text{F}$ ) | Working Voltage (Vdc) |      |      |      |      |      |      |     |
|-----------------------|-----------------------|------|------|------|------|------|------|-----|
|                       | 6.3                   | 10   | 16   | 25   | 35   | 50   | 63   | 100 |
| 0.47                  | -                     | -    | -    | -    | -    | 10   | -    | 11  |
| 1.0                   | -                     | -    | -    | -    | -    | 12   | -    | 15  |
| 2.2                   | -                     | -    | -    | -    | -    | 20   | -    | 25  |
| 3.3                   | -                     | -    | -    | -    | -    | 26   | -    | 35  |
| 4.7                   | -                     | -    | -    | -    | -    | 33   | 35   | 45  |
| 10                    | -                     | -    | 28   | -    | 50   | 55   | 60   | 70  |
| 22                    | -                     | -    | 50   | 70   | 75   | 85   | 100  | 120 |
| 33                    | -                     | -    | 80   | 85   | 95   | 110  | 140  | 170 |
| 47                    | -                     | 70   | 95   | 100  | 120  | 140  | 190  | 230 |
| 100                   | -                     | 130  | 160  | 170  | 210  | 230  | 300  | 370 |
| 150                   | -                     | 170  | 210  | 220  | 290  | 330  | 400  | 490 |
| 220                   | -                     | 210  | 260  | 270  | 370  | 420  | 490  | 600 |
| 330                   | 240                   | 290  | 330  | 400  | 470  | 580  | 680  | 700 |
| 470                   | 330                   | 350  | 440  | 510  | 600  | 730  | 880  | 930 |
| 680                   | 460                   | -    | -    | -    | -    | -    | -    | -   |
| 1,000                 | 570                   | 660  | 760  | 900  | 960  | 1100 | 1300 | -   |
| 1,500                 | 790                   | 870  | 1050 | 1100 | 1200 | 1500 | 1600 | -   |
| 2,200                 | 940                   | 1000 | 1200 | 1300 | 1400 | 1700 | 2200 | -   |
| 3,300                 | 1100                  | 1200 | 1400 | 1600 | 1700 | 2200 | 2300 | -   |
| 4,700                 | 1300                  | 1500 | 1700 | 1900 | 2400 | 2500 | -    | -   |
| 6,800                 | 1600                  | 1700 | 2000 | 2550 | -    | -    | -    | -   |
| 10,000                | 1800                  | 1900 | 2650 | 2750 | -    | -    | -    | -   |

### MAXIMUM ESR ( $\Omega$ ) AT 20°C AND 120Hz

| Cap ( $\mu\text{F}$ ) | Working Voltage (Vdc) |        |        |        |        |        |       |       |
|-----------------------|-----------------------|--------|--------|--------|--------|--------|-------|-------|
|                       | 6.3                   | 10     | 16     | 25     | 35     | 50     | 63    | 100   |
| 0.47                  | -                     | -      | -      | -      | -      | 353    | -     | 283   |
| 1.0                   | -                     | -      | -      | -      | -      | 166    | -     | 133   |
| 2.2                   | -                     | -      | -      | -      | -      | 75.4   | -     | 60.4  |
| 3.3                   | -                     | -      | -      | -      | -      | 50.3   | -     | 40.3  |
| 4.7                   | -                     | -      | -      | -      | -      | 35.3   | 31.8  | 28.3  |
| 10                    | -                     | -      | 26.5   | -      | 19.9   | 16.6   | 15.0  | 13.3  |
| 22                    | -                     | -      | 7.53   | 10.6   | 9.05   | 7.54   | 6.79  | 6.04  |
| 33                    | -                     | -      | 8.05   | 7.04   | 6.04   | 5.03   | 4.53  | 4.03  |
| 47                    | -                     | 7.05   | 5.65   | 4.94   | 4.24   | 3.53   | 3.18  | 2.83  |
| 100                   | -                     | 3.16   | 2.66   | 2.33   | 1.99   | 1.66   | 1.50  | 1.33  |
| 150                   | -                     | 1.68   | 1.42   | 1.24   | 1.08   | 0.880  | 0.800 | 0.710 |
| 220                   | -                     | 1.44   | 1.21   | 1.06   | 0.905  | 0.754  | 0.679 | 0.604 |
| 330                   | 1.11                  | 0.956  | 0.805  | 0.704  | 0.604  | 0.503  | 0.453 | 0.403 |
| 470                   | 0.777                 | 0.671  | 0.565  | 0.494  | 0.424  | 0.353  | 0.318 | 0.283 |
| 680                   | 0.526                 | -      | -      | -      | -      | -      | -     | -     |
| 1,000                 | 0.365                 | 0.316  | 0.266  | 0.233  | 0.199  | 0.166  | 0.150 | -     |
| 1,500                 | 0.243                 | 0.210  | 0.177  | 0.155  | 0.133  | 0.111  | 0.099 | -     |
| 2,200                 | 0.181                 | 0.159  | 0.136  | 0.121  | 0.106  | 0.0905 | 0.083 | -     |
| 3,300                 | 0.131                 | 0.116  | 0.101  | 0.0905 | 0.0805 | 0.0829 | 0.065 | -     |
| 4,700                 | 0.0988                | 0.0883 | 0.0777 | 0.0706 | 0.0635 | 0.07   | -     | -     |
| 6,800                 | 0.0781                | 0.0708 | 0.0653 | 0.059  | -      | -      | -     | -     |
| 10,000                | 0.0663                | 0.0614 | 0.0564 | 0.0531 | -      | -      | -     | -     |

### RIPPLE CURRENT CORRECTION FACTOR

#### 1. Temperature Factor

| Ambient Temperature (°C) | 60   | 70   | 85   |
|--------------------------|------|------|------|
| Correction Rate          | 1.50 | 1.30 | 1.00 |

#### 2. Frequency Factor

| Frequency (Hz)             | 50   | 120  | 300  | 1K   | 10K  |
|----------------------------|------|------|------|------|------|
| ~ 47 $\mu\text{F}$         | 0.75 | 1.00 | 1.35 | 1.57 | 2.00 |
| 100 ~ 470 $\mu\text{F}$    | 0.80 | 1.00 | 1.23 | 1.34 | 1.50 |
| 1000 $\mu\text{F}$ ~       | 0.85 | 1.00 | 1.10 | 1.13 | 1.15 |
| 2200 ~ 10000 $\mu\text{F}$ | 0.85 | 1.00 | 1.03 | 1.05 | 1.08 |

NRSA 101 M 16V 6.3x11 TR F  
 Series Capacitance Code Tolerance Code Rated Voltage Size (D $\phi$  x L) Tape and Reel Pb Free (Optional 100% Sn)