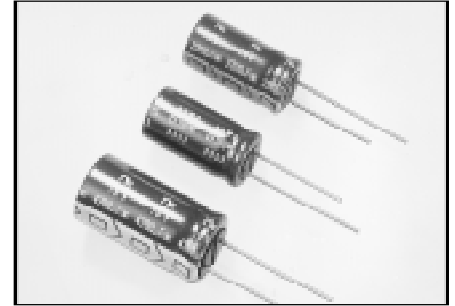


RADIAL LEADS, POLARIZED, STANDARD SIZE  
EXTENDED TEMPERATURE

### FEATURES

- REDUCED CASE SIZING
- -55°C ~ +105°C EXTENDED OPERATING TEMPERATURE
- HIGH STABILITY OVER LONG LIFE

EXTENDED TEMPERATURE  
**NRWA** ➔ **NRWS**  
(today's standard) (reduced sizes)



LEADED

### CHARACTERISTICS

|                                                                                   |              |                                      |                                           |      |      |      |      |      |      |      |
|-----------------------------------------------------------------------------------|--------------|--------------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
| Rated Voltage Range                                                               |              | 6.3 ~ 100 VDC                        |                                           |      |      |      |      |      |      |      |
| Capacitance Range                                                                 |              | 0.47 ~ 10,000μF                      |                                           |      |      |      |      |      |      |      |
| Operating Temperature Range                                                       |              | -55 ~ +105°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                          | 0.22                                      | 0.19 | 0.16 | 0.14 | 0.12 | 0.10 | 0.09 | 0.08 |
|                                                                                   |              | C = 2,200μF                          | 0.24                                      | 0.21 | 0.18 | 0.16 | 0.14 | 0.12 |      |      |
|                                                                                   |              | C = 3,300μF                          | 0.26                                      | 0.23 | 0.20 | 0.18 | 0.16 |      |      |      |
|                                                                                   |              | C = 4,700μF                          | 0.28                                      | 0.25 | 0.22 | 0.20 |      |      |      |      |
|                                                                                   |              | C = 6,800μF                          | 0.32                                      | 0.29 | 0.26 |      |      |      |      |      |
| Low Temperature Stability Impedance Ratio @ 120Hz                                 |              | C = 10,000μF                         | 0.40                                      | 0.37 |      |      |      |      |      |      |
|                                                                                   |              | Z-25°C/Z+20°C                        | 4                                         | 3    | 2    | 2    | 2    | 2    | 2    | 2    |
|                                                                                   |              | Z-40°C/Z+20°C                        | 8                                         | 6    | 4    | 3    | 3    | 3    | 3    | 3    |
| Load Life Test at Rated W.V.<br>105°C 1,000 Hours: 5 ~ 12.5Ø<br>2,000 Hours: 16 Ø |              | 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>105°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         |      |      |      |      |      |      |      |

### MAXIMUM E.S.R. (Ω) AT 120Hz AND 20°C

| Cap (μF) | Working Voltage (Vdc) |       |       |       |       |       |       |      |
|----------|-----------------------|-------|-------|-------|-------|-------|-------|------|
|          | 6.3V                  | 10V   | 16V   | 25V   | 35V   | 50V   | 63V   | 100V |
| 0.47     |                       |       |       |       |       | 353   |       | 282  |
| 1.0      |                       |       |       |       |       | 168   |       | 133  |
| 2.2      |                       |       |       |       |       | 75    |       | 60   |
| 3.3      |                       |       |       |       |       | 50    | 40    | 40   |
| 4.7      |                       |       |       | 49    | 42    | 35    | 32    | 28   |
| 10       |                       |       | 26.5  | 23    | 19.9  | 16.6  | 15.0  | 13.3 |
| 22       |                       | 14.3  | 12.1  | 10.8  | 9.0   | 7.5   | 6.8   | 6.0  |
| 33       | 11.1                  | 9.6   | 8.0   | 7.0   | 6.0   | 5.0   | 4.5   | 4.0  |
| 47       | 7.8                   | 6.7   | 5.8   | 4.9   | 4.2   | 3.5   | 3.2   | 2.8  |
| 100      | 3.7                   | 3.2   | 2.7   | 2.3   | 2.0   | 1.66  | 1.49  | 1.33 |
| 220      |                       | 1.43  | 1.21  | 1.1   | 0.90  | 0.75  | 0.68  | 0.60 |
| 330      | 1.11                  |       | 0.80  | 0.70  | 0.60  | 0.50  | 0.45  | 0.40 |
| 470      | 0.78                  | 0.67  | 0.66  | 0.49  | 0.42  | 0.35  | 0.32  | 0.28 |
| 1000     | 0.36                  | 0.32  | 0.27  | 0.23  | 0.20  | 0.166 | 0.149 |      |
| 2200     | 0.181                 | 0.158 | 0.136 | 0.121 | 0.106 | 0.091 |       |      |
| 3300     | 0.131                 | 0.116 | 0.101 | 0.090 | 0.081 |       |       |      |
| 4700     | 0.099                 | 0.088 | 0.078 | 0.071 |       |       |       |      |
| 6800     | 0.078                 | 0.071 | 0.063 |       |       |       |       |      |
| 10000    | 0.063                 | 0.058 |       |       |       |       |       |      |

### MAXIMUM RIPPLE CURRENT (mA rms) AT 105°C, 120Hz

| Cap (μF) | Working Voltage (Vdc) |      |      |      |      |      |      |      |
|----------|-----------------------|------|------|------|------|------|------|------|
|          | 6.3V                  | 10V  | 16V  | 25V  | 35V  | 50V  | 63V  | 100V |
| 0.47     |                       |      |      |      |      | 8.3  |      | 8.8  |
| 1.0      |                       |      |      |      |      | 12   |      | 13   |
| 2.2      |                       |      |      |      |      | 18   |      | 19   |
| 3.3      |                       |      |      |      |      | 22   | 23   | 23   |
| 4.7      |                       |      |      | 22   | 24   | 26   | 28   | 30   |
| 10       |                       |      | 31   | 33   | 35   | 38   | 41   | 49   |
| 22       |                       | 42   | 45   | 49   | 52   | 57   | 69   | 84   |
| 33       | 47                    | 51   | 55   | 59   | 64   | 80   | 85   | 120  |
| 47       | 57                    | 61   | 68   | 71   | 87   | 96   | 120  | 160  |
| 100      | 82                    | 89   | 110  | 120  | 150  | 160  | 200  | 280  |
| 220      |                       | 150  | 190  | 200  | 260  | 310  | 350  | 500  |
| 330      | 170                   |      | 230  | 290  | 350  | 410  | 480  | 610  |
| 470      | 230                   | 250  | 320  | 380  | 450  | 540  | 620  | 780  |
| 1000     | 400                   | 470  | 560  | 670  | 780  | 950  | 1080 |      |
| 2200     | 760                   | 790  | 950  | 1110 | 1280 | 1480 |      |      |
| 3300     | 890                   | 1000 | 1220 | 1380 | 1570 |      |      |      |
| 4700     | 1230                  | 1270 | 1490 | 1670 |      |      |      |      |
| 6800     | 1340                  | 1540 | 1770 |      |      |      |      |      |
| 10000    | 1610                  | 1770 |      |      |      |      |      |      |

### RIPPLE CURRENT CORRECTION FACTOR

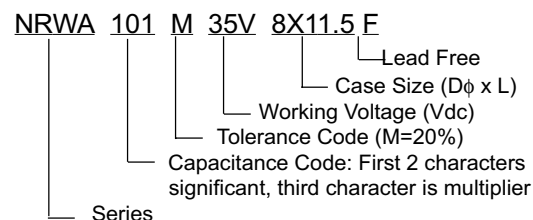
#### 1. Temperature Factor

| Ambient Temperature (°C) | ≤+65 | +75  | +85  | +105 |
|--------------------------|------|------|------|------|
| Correction Rate          | 1.60 | 1.40 | 1.40 | 1.00 |

#### 2. Frequency Factor

| Frequency (Hz) | 50   | 120  | 300  | 1K   | 10K  | 100K |
|----------------|------|------|------|------|------|------|
| 0.47 ~ 3.3μF   | 0.65 | 1.00 | 1.35 | 1.75 | 2.30 | 2.50 |
| 4.7 ~ 33μF     | 0.75 | 1.00 | 1.25 | 1.50 | 1.75 | 1.80 |
| 47 ~ 1000μF    | 0.80 | 1.00 | 1.15 | 1.30 | 1.40 | 1.50 |
| 2200 ~ 10000μF | 0.85 | 1.00 | 1.03 | 1.05 | 1.08 | 1.08 |

### PART NUMBERING SYSTEM

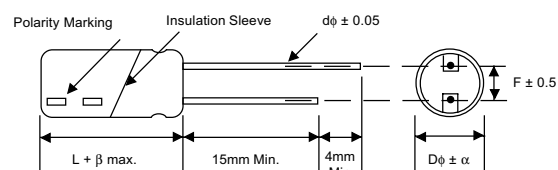


### STANDARD PRODUCTS AND CASE SIZE TABLE D φ x L (mm)

| Cap (μF) | Code | Working Voltage (Vdc) |           |           |           |           |           |           |           |
|----------|------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|          |      | 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    | 5 x 11    |
| 4.7      | 4R7  |                       |           |           |           |           | 5 x 11    | 5 x 11    | 5 x 11    |
| 10       | 100  |                       |           |           |           | 5 x 11    | 5 x 11    | 5 x 11    | 6.3 x 11  |
| 22       | 220  |                       |           |           | 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    | 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 |
| 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  | 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   |
| 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   |           |
| 2200     | 222  | 12.5 x 20             | 12.5 x 20 | 12.5 x 25 | 16 x 25   | 16 x 31   | 18 x 36   |           |           |
| 3300     | 332  | 12.5 x 20             | 12.5 x 25 | 16 x 25   | 16 x 31   | 18 x 36   |           |           |           |
| 4700     | 472  | 16 x 25               | 16 x 25   | 16 x 31   | 18 x 36   |           |           |           |           |
| 6800     | 682  | 16 x 25               | 16 x 31   | 18 x 36   |           |           |           |           |           |
| 10,000   | 103  | 16 x 31               | 18 x 36   |           |           |           |           |           |           |

### LEAD SPACING AND DIAMETER (mm)

| Case Dia. (Dφ)   | 5   | 6.3 | 8   | 10  | 12.5 | 16  | 18  |
|------------------|-----|-----|-----|-----|------|-----|-----|
| Leads Dia. (dφ)  | 0.5 | 0.5 | 0.6 | 0.6 | 0.6  | 0.8 | 0.8 |
| Lead Spacing (F) | 2.0 | 2.5 | 3.5 | 5.0 | 5.0  | 7.5 | 7.5 |
| Dim. α           | 0.5 | 0.5 | 0.5 | 0.5 | 0.5  | 0.5 | 0.5 |



$\beta = L < 20\text{mm} = 1.5\text{mm}, L \geq 20\text{mm} = 2.0\text{mm}$   
SLEEVE COLOR: DARK BROWN