# Surface Mount Aluminum Electrolytic Capacitors NACE Series

## FEATURES

- LOW COST, GENERAL PURPOSE, 2000 HOURS AT 85°C
- NEW EXPANDED CV RANGE (up to 6800µF)
- ANTI-SOLVENT (2 MINUTES)
- DESIGNED FOR AUTOMATIC MOUNTING AND REFLOW SOLDERING

## CHARACTERISTICS

| | |
|---|---|
| Rated Voltage Range | 4.0 ~ 100Vdc |
| Rate Capacitance Range | 0.1 ~ 6,800µF |
| Oerating Temp. Range | -40°C ~ +85°C |
| Capacitance Tolerance | ±20% (M), ±10% |
| Max. Leakage Current After 2 Minutes @ 20°C | 0.01CV or 3µA whichever is greater |

**RoHS Compliant**
includes all homogeneous materials

*See Part Number System for Details

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tan δ @120Hz/20°C | W.V. (Vdc) | | 4.0 | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| | 3mm Dia. | | 0.40 | 0.35 | 0.24 | 0.19 | 0.16 | 0.14 | 0.14 | - | - |
| | 4 ~ 6.3mm Dia. | | 0.35 | 0.26 | 0.20 | 0.16 | 0.14 | 0.12 | 0.10 | 0.10 | 0.10 |
| | 8x6.5mm Dia. | | - | 0.25 | 0.26 | 0.20 | 0.16 | 0.14 | 0.12 | - | 0.10 |
| | 8mm Dia. ~ up | C<1000µF | 0.40 | 0.30 | 0.24 | 0.20 | 0.16 | 0.14 | 0.12 | 0.12 | 0.10 |
| | | C<1500µF | - | 0.31 | 0.25 | 0.21 | - | 0.15 | - | - | - |
| | | C<2200µF | - | 0.32 | 0.32 | - | 0.18 | - | - | - | - |
| | | C<3300µF | - | 0.34 | - | 0.24 | - | - | - | - | - |
| | | C<4700µF | - | - | 0.36 | - | - | - | - | - | - |
| | | C<6800µF | - | 0.40 | - | - | - | - | - | - | - |
| Low Temperature Stability Impedance Ratio @ 120Hz | W.V. (Vdc) | | 4.0 | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| | Z-25°C/Z+20°C | | 7 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Z-40°C/Z+20°C | | 15 | 8 | 6 | 4 | 4 | 3 | 3 | 3 | 3 |
| Load Life Test 85°C 2,000 Hours | Capacitance Change | | Within ± 25% of initial measured value | | | | | | | | |
| | Tan δ | | Less than 200% of specified max. value | | | | | | | | |
| | Leakage Current | | Less than specified max. value | | | | | | | | |

*See standard products and case size table for items available in 10% tolerance

## PART NUMBER SYSTEM

NACE 101 M 16V 6.3x5.5 TR 13 F

- F — Pb-free/RoHS Compliant* 97% Sn (min.), 3% Bi (max.)
- 13 — 330mm (13") Reel
- TR — Tape & Reel
- 6.3x5.5 — Size in mm
- 16V — Working Voltage
- M — Tolerance Code M=20%, K=10%
- 101 — Capacitance Code in mF, first 2 digits are significant Third digit is no. of zeros, "R" indicates decimal for values under 10mF
- NACE — Series

*Add "F" suffix for optional RoHS compliant parts

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

| Cap (µF) | Working Voltage (Vdc) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4.0 | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| 0.1 | - | - | - | - | - | - | 1.0 | 1.0 | - |
| 0.22 | - | - | - | - | - | - | 2.3 | 2.3 | - |
| 0.33 | - | - | - | - | - | - | 3.5 | 3.5 | - |
| 0.47 | - | - | - | - | - | - | 4.0* 5.5 | 5.0 | - |
| 1.0 | - | - | - | - | - | - | 8* 10 | 10 | 10 |
| 2.2 | - | - | - | - | - | 8* | 15 | 15 | 20 |
| 3.3 | - | - | - | - | - | 10* | 15 | 15 | 28* 50† |
| 4.7 | - | - | - | - | 12* 19 | 20 | 23 | 23 | 35 |
| 10 | - | - | - | 20* 25 | 28 | 30 | 34 | 34 | 50 |
| 15 | - | 16* | - | - | - | - | - | - | - |
| 22 | 19* | 21* 31 | 35 | 39 | 52 | 54 | 58 120† | 70 | 120 |
| 33 | 26 | 39 | 43 | 57 | 63 | 60 130† | 65† 85 | 160 | 190 |
| 47 | 34 | 47 | 59 | 68 | 68 | 70 165† | 90 | 170 | 330 |
| 68 | 52 | 63 | 66 | 75 | 80 | 110 | 120 | - | - |
| 100 | 61 | 71 | 76 | 86 200† | 91 130† | 130 | 200 | 280 | - |
| 150 | 74 | 78 | 88 | 135 | 200 | 220 | - | - | 560 |
| 220 | 82 | 95 | 150 250† | 150 | 250 | 270 | 320 | 410 | - |
| 330 | 80 | 150 300† | 280 | 280 | 310 | 340 | 520 | - | - |
| 470 | 150 | 300 | 300 | 330 | 430 | 590 | 925 | 700 | - |
| 680 | - | 300 | - | 450 | - | 610 | - | - | - |
| 1000 | 330 | 330 | 450 | - | 660 | - | 940 | - | - |
| 1500 | - | 450 | - | 710 | - | 1060 | - | - | - |
| 2200 | - | - | 730 | - | 1150 | - | - | - | - |
| 3300 | - | 750 | - | 1200 | - | - | - | - | - |
| 4700 | - | 1260 | - | - | - | - | - | - | - |
| 6800 | - | 1330 | - | - | - | - | - | - | - |

***3x5.5mm Case Size, †8x6.5mm Case Size**

## MAXIMUM ESR (Ω) AT 20°C AND 120Hz

| Cap (µF) | Working Voltage (Vdc) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4.0 | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| 0.1 | - | - | - | - | - | - | 1660 | 1660 | - |
| 0.22 | - | - | - | - | - | - | 754 | 754 | - |
| 0.33 | - | - | - | - | - | - | 503 | 503 | - |
| 0.47 | - | - | - | - | - | - | 353 | 353 | - |
| 1.0 | - | - | - | - | - | - | 166 | 166 | 166 |
| 2.2 | - | - | - | - | - | 90.4 | 75.4 | 75.4 | 75.4 |
| 3.3 | - | - | - | - | - | 60.3 | 50.3 | 50.3 | 50.3 90.4† |
| 4.7 | - | - | - | - | 4.94 | 42.3 | 35.3 | 35.3 | 35.3 |
| 10 | - | - | - | 26.5 | 23.2 | 19.9 | 16.6 | 16.6 | 16.6 |
| 15 | - | 33.1 | - | - | - | - | - | - | - |
| 22 | 30.1 | 26.5* 18.1 | 15.1 | 12.1 | 10.6 | 9.05 | 7.54 9.05† | 7.54 | 7.54 |
| 33 | 17.6 | 12.6 | 10.1 | 8.04 | 7.04 | 6.04 7.04† | 5.03 6.04† | 6.04 | 5.03 |
| 47 | 12.4 | 8.47 | 7.06 | 5.65 | 4.95 | 4.24 4.95† | 3.53 | 4.24 | - |
| 68 | 8.54 | 5.86 | 4.88 | 3.91 | 3.42 | 2.93 | 2.44 | - | - |
| 100 | 5.80 | 3.98 | 3.32 | 2.66 3.32† | 2.32 2.66† | 1.99 | 1.99 | 1.99 | - |
| 150 | 3.87 | 2.66 | 2.21 | 1.77 | 1.55 | 1.33 | - | - | 1.11 |
| 220 | 2.64 | 1.96 | 1.51 1.99† | 1.21 | 1.21 | 1.06 | 0.91 | 0.91 | - |
| 330 | 1.76 | 1.31 1.76† | 1.21 | 1.01 | 0.81 | 0.71 | 0.60 | - | - |
| 470 | 1.42 | 1.06 | 0.85 | 0.71 | 0.57 | 0.49 | 0.43 | 0.43 | - |
| 680 | - | 0.59 | - | 0.49 | - | 0.34 | - | - | - |
| 1000 | 0.67 | 0.50 | 0.40 | - | 0.27 | - | 0.20 | - | - |
| 1500 | - | 0.35 | - | 0.24 | - | 0.17 | - | - | - |
| 2200 | - | - | 0.24 | - | 0.14 | - | - | - | - |
| 3300 | - | 0.17 | - | 0.12 | - | - | - | - | - |
| 4700 | - | - | 0.13 | - | - | - | - | - | - |
| 6800 | - | 0.10 | - | - | - | - | - | - | - |

## RIPPLE CURRENT CORRECTION FACTOR

| Frequency Hz | 100<F≤1K | 1K<F≤10K | 10K<F≤100K | F≥100K |
|---|---|---|---|---|
| C≤4.7µF | 1.0 | 1.3 | 1.5 | 2.0 |
| 4.7µF<C≤33µF | 1.0 | 1.2 | 1.3 | 1.45 |
| C>33µF | 1.0 | 1.1 | 1.2 | 1.3 |

## STANDARD PRODUCT AND CASE SIZE TABLE DϕxL (mm)

| Cap. (µF) | Code | Working Voltage (Vdc) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 4.0 | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 |
| 0.1 | R10 | | | | | | | 3x5.5<br>4x5.5* | 4x5.5* | |
| 0.22 | R22 | | | | | | | 3x5.5<br>4x5.5* | 4x5.5* | |
| 0.33 | R33 | | | | | | | 3x5.5<br>4x5.5* | 4x5.5* | |
| 0.47 | R47 | | | | | | | 3x5.5<br>4x5.5* | 4x5.5* | |
| 1.0 | 1R0 | | | | | | | 3x5.5<br>4x5.5* | 4x5.5* | 4x6.3* |
| 2.2 | 2R2 | | | | | | 3x5.5 | 4x5.5* | 4x5.5* | 6.3x6.3* |
| 3.3 | 3R3 | | | | | | 3x5.5 | 4x5.5* | 5x5.5* | 6.3x6.3*<br>8x6.5 |
| 4.7 | 4R7 | | | | | 3x5.5<br>4x5.5 | 4x5.5* | 5x5.5* | 5x5.5* | 6.3x6.3* |
| 10 | 100 | | | | 3x5.5<br>4x5.5* | 5x5.5 | 5x5.5* | 6.3x5.5* | 6.3x5.5* | 6.3x8* |
| 15 | 150 | - | 3x5.5 | - | - | - | - | - | - | - |
| 22 | 220 | 3x5.5 | 3x5.5<br>4x5.5* | 5x5.5* | 5x5.5* | 6.3x5.5 | 6.3x5.5* | 6.3x6.3*<br>8x6.5 | 6.3x8* | 8x10.5* |
| 33 | 330 | 4x5.5* | 5x5.5* | 5x5.5* | 6.3x5.5* | 6.3x5.5 | 6.3x6.3*<br>8x6.5 | 6.3x8*<br>8x6.5 | 8x10.5* | 10x10.5* |
| 47 | 470 | 4x5.5* | 5x5.5* | 6.3x5.5 | 6.3x5.5* | 6.3x6.3 | 6.3x6.3*<br>8x6.5 | 6.3x8* | 8x10.5* | 12.5x14 |
| 68 | 680 | 5x5.5* | 6.3x5.5* | 6.3x5.5* | 6.3x5.5* | 6.3x6.3 | 6.3x8 | 8x10.5* | | |
| 100 | 101 | 5x5.5* | 6.3x5.5* | 6.3x5.5* | 6.3x5.5*<br>8x6.5 | 6.3x8<br>8x6.5 | 6.3x8 | 8x10.5* | 10x10.5* | |
| 150 | 151 | 6.3x5.5* | 6.3x5.5* | 6.3x6.3* | 6.3x8* | 8x10.5 | 8x10.5*<br>10x8* | | | 16x17 |
| 220 | 221 | 6.3x5.5* | 6.3x6.3* | 6.3x8*<br>8x6.5 | 6.3x8* | 8x10.5<br>10x8 | 8x10.5 | 10x10.5 | 12.5x14 | |
| 330 | 331 | 6.3x6.3 | 6.3x8*<br>8x6.5 | 8x10.5* | 8x10.5<br>10x8 | 8x10.5 | 10x10.5 | 12.5x14 | | |
| 470 | 471 | 6.3x8* | 8x10.5 | 8x10.5<br>10x8 | 8x10.5 | 10x10.5 | 12.5x14 | 16x17 | 16x17 | |
| 680 | 681 | | 10x8* | | 10x10.5* | | 12.5x14 | | | |
| 1000 | 102 | 10x8 | 8x10.5* | 10x10.5* | | 12.5x14 | | 16x17 | | |
| 1500 | 152 | | 10x10.5* | | 12.5x14 | | 16x17 | | | |
| 2200 | 222 | | | 12.5x14 | | 16x17 | | | | |
| 3300 | 332 | | 12.5x14 | | 16x17 | | | | | |
| 4700 | 472 | | | 16x17 | | | | | | |
| 6800 | 682 | | 16x17 | | | | | | | |

*Items available in optional 10% tolerance

**SEE PAGE 38**
**For Case Size Data**
**SEE PAGE 39**
**For Taping/Packaging Data**