

# Panasonic<sup>®</sup> FM Series Radial Lead Aluminum Electrolytic Capacitors



**FEATURES:**

• Low Impedance: 40 ~ 70% lower than FC Series • High Ripple Current: 50% higher than FC Series • Long Life: 2000 ~ 7000 hours at 105°C • PVC free, Pb free • Appearance: Black body with gold markings

**SPECIFICATIONS:**

• Operating Temperature Range: -40°C ~ 105°C • Capacitance Tolerance: ±20% (120Hz, 20°C) • Leakage Current:  $I \leq 0.01 CV$  ( $\mu A$ ) measured after 2 minutes application of rated working voltage at 20°C

•  $\tan \delta$  (120 Hz, 20°C)

| Working volt. (VDC) | 6.3  | 10   | 16   | 25   | 35   | 50   |
|---------------------|------|------|------|------|------|------|
| $\tan \delta$ max.  | 0.22 | 0.19 | 0.16 | 0.14 | 0.12 | 0.10 |

For capacitance value > 1000 $\mu F$ , add 0.02 per every 1000 $\mu F$ .

• Impedance at High Frequency: Refer to standard product table • Ripple Current: Refer to standard product table (100kHz, 105°C)

**Endurance:**

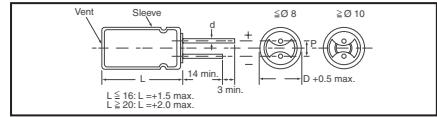
**Test Conditions** — Duration: 3000 hours (for  $\Phi 8 \times 11.5 - 15mm$ ), 4000 hours (for  $\Phi 8 \times 20, \Phi 10 \times 12.5 - 16mm$ ), 5000 hours (for  $\Phi 10 \times 20 - 25, \Phi 12.5 \times 20, \Phi 16 \times 20mm$ ), 7000 hours (for  $\Phi 12.5 \times 25 - 35, \Phi 16 \times 25mm$ ) • **Ambient Temperature:** 105°C ±2°C • **Applied Voltage:** DC voltage with maximum permissible ripple current specified at 105°C (the sum of the DC voltage and super-imposed peak AC voltage for maximum permissible ripple current should be equal to rated DC working voltage.)

**Post Test Requirements at 20°C** — Leakage Current:  $\leq$  Initial specified value • Capacitance change: 16V ~ 50V:  $\pm 25\%$  of initial measured value (6.3V ~ 10V:  $\pm 30\%$ ) •  $\tan \delta$ :  $\leq 200\%$  of initial specified value

**Shelf Life:** After storage for 1000 hours at 105 ±2°C with no voltage applied and then being stabilized at 20°C, capacitor shall meet the limits specified in Endurance. (With voltage treatment)

**Frequency Correction Factor for Ripple Current**

| W.V. (VDC) | Capacitance ( $\mu F$ ) | Frequency (Hz) |      |      |      |      |
|------------|-------------------------|----------------|------|------|------|------|
|            |                         | 60             | 120  | 1K   | 10K  | 100K |
| 6.3 ~ 50   | 22 ~ 33                 | 0.45           | 0.55 | 0.75 | 0.90 | 1.00 |
|            | 47 ~ 330                | 0.60           | 0.70 | 0.85 | 0.95 | 1.00 |
|            | 390 ~ 1000              | 0.65           | 0.75 | 0.90 | 0.98 | 1.00 |
|            | 1200 ~ 6800             | 0.75           | 0.80 | 0.95 | 1.00 | 1.00 |



| W.V. (VDC) | Cap. ( $\mu F$ ) | Dimensions (mm) |      |     |          | Leakage Current (20°C) (2 min.) ( $\mu A$ ) Maximum | Impedance (100kHz) (20°C) ( $\Omega$ ) Maximum | Ripple Current (100kHz @ 105°C) (mA) rms Maximum | Life Time (hours) | Digi-Key Part No. | Pricing |       |        |              | Panasonic Part No. |
|------------|------------------|-----------------|------|-----|----------|---|--|--|-------------------|-------------------|---------|-------|--------|--------------|--------------------|
|            |                  | $\Phi$ D        | L    | P   | $\Phi$ d |   |  |  |                   |                   | 1       | 50    | 100    | 500          |                    |
| 6.3        | 150              | 5               | 11   | 2.0 | 0.5      | 9.5   | 0.300  | 280  | 2000              | P12917-ND         | .35     | 8.03  | 13.66  | 48.21        | EEU-FM0J151        |
|            | 330              | 6               | 11.2 | 2.5 | 0.5      | 20.8  | 0.130  | 455  | 2000              | P12918-ND         | .36     | 8.90  | 15.08  | 56.56        | EEU-FM0J331        |
|            | 560              | 8               | 11.5 | 3.5 | 0.6      | 35.3  | 0.056  | 950  | 3000              | P12348-ND         | .50     | 12.23 | 20.97  | 78.65        | EEU-FM0J561        |
|            | 820              | 8               | 15   | 3.5 | 0.6      | 51.7  | 0.041  | 1240   | 3000              | P12352-ND         | .56     | 15.12 | 26.33  | 97.52        | EEU-FM0J821L       |
|            | 1000             | 10              | 12.5 | 5.0 | 0.6      | 63.0  | 0.038  | 1290   | 4000              | P12340-ND         | .57     | 15.28 | 26.63  | 98.64        | EEU-FM0J102        |
|            | 1200             | 10              | 16   | 5.0 | 0.6      | 75.6  | 0.026  | 1790   | 4000              | P12341-ND         | .76     | 20.39 | 35.51  | 131.52       | EEU-FM0J122        |
|            | 1500             | 8               | 20   | 3.5 | 0.6      | 75.6  | 0.030  | 1560   | 4000              | P12342-ND         | .66     | 17.65 | 30.76  | 113.90       | EEU-FM0J122L       |
|            | 1200             | 10              | 20   | 5.0 | 0.6      | 94.5  | 0.019  | 2180   | 5000              | P12343-ND         | .75     | 22.08 | 37.86  | 149.89       | EEU-FM0J152        |
|            | 2200             | 10              | 25   | 5.0 | 0.6      | 138.6   | 0.018  | 2470   | 5000              | P12344-ND         | .84     | 24.83 | 42.57  | 168.55       | EEU-FM0J222L       |
|            | 3300             | 12.5            | 20   | 5.0 | 0.6      | 207.9   | 0.018  | 2600   | 5000              | P12345-ND         | .95     | 29.96 | 51.61  | 199.77       | EEU-FM0J332        |
|            | 3900             | 12.5            | 25   | 5.0 | 0.6      | 245.7   | 0.015  | 3190   | 7000              | P12346-ND         | 1.19    | 37.70 | 64.94  | 251.38       | EEU-FM0J392        |
|            | 4700             | 12.5            | 30   | 5.0 | 0.8      | 296.1   | 0.013  | 3630   | 7000              | P12347-ND         | 1.09    | 37.39 | 64.71  | 244.47       | EEU-FM0J472L       |
| 5600       | 12.5             | 35              | 5.0  | 0.8 | 352.8    | 0.012   | 3750   | 7000   | P12349-ND         | 1.60              | 54.94   | 95.09 | 359.21 | EEU-FM0J562L |                    |
| 5600       | 16               | 20              | 7.5  | 0.8 | 352.8    | 0.017   | 3300   | 5000   | P12350-ND         | 1.31              | 44.88   | 77.66 | 293.40 | EEU-FM0J562S |                    |
| 6800       | 16               | 25              | 7.5  | 0.8 | 428.4    | 0.014   | 3820   | 7000   | P12351-ND         | 1.56              | 53.40   | 92.43 | 349.20 | EEU-FM0J682  |                    |
| 10         | 100              | 5               | 11   | 2.0 | 0.5      | 10.0  | 0.300  | 280  | 2000              | P12919-ND         | .35     | 8.03  | 13.66  | 48.21        | EEU-FM1A101        |
|            | 220              | 6               | 11.2 | 2.5 | 0.5      | 22.0  | 0.130  | 455  | 2000              | P12920-ND         | .36     | 8.90  | 15.08  | 56.56        | EEU-FM1A221        |
|            | 470              | 8               | 11.5 | 3.5 | 0.6      | 47.0  | 0.056  | 950  | 3000              | P12361-ND         | .50     | 12.23 | 20.97  | 78.65        | EEU-FM1A471        |
|            | 680              | 10              | 12.5 | 5.0 | 0.6      | 68.0  | 0.038  | 1290   | 4000              | P12364-ND         | .57     | 15.28 | 26.63  | 98.64        | EEU-FM1A681        |
|            | 680              | 8               | 15   | 3.5 | 0.6      | 68.0  | 0.041  | 1240   | 3000              | P12365-ND         | .56     | 15.12 | 26.33  | 97.52        | EEU-FM1A681L       |
|            | 1000             | 10              | 16   | 5.0 | 0.6      | 100.0   | 0.026  | 1790   | 4000              | P12353-ND         | .76     | 20.39 | 35.51  | 131.52       | EEU-FM1A102        |
|            | 1000             | 8               | 20   | 3.5 | 0.6      | 100.0   | 0.030  | 1560   | 4000              | P12354-ND         | .66     | 17.65 | 30.76  | 113.90       | EEU-FM1A102L       |
|            | 1200             | 10              | 20   | 5.0 | 0.6      | 120.0   | 0.019  | 2180   | 5000              | P12355-ND         | .75     | 22.08 | 37.86  | 149.89       | EEU-FM1A122        |
|            | 1500             | 10              | 25   | 5.0 | 0.6      | 150.0   | 0.018  | 2470   | 5000              | P12356-ND         | .84     | 24.83 | 42.57  | 168.55       | EEU-FM1A152L       |
|            | 2200             | 12.5            | 20   | 5.0 | 0.6      | 220.0   | 0.018  | 2600   | 5000              | P12357-ND         | .95     | 29.96 | 51.61  | 199.77       | EEU-FM1A222        |
|            | 3300             | 12.5            | 25   | 5.0 | 0.6      | 330.0   | 0.015  | 3190   | 7000              | P12735-ND         | 1.19    | 37.70 | 64.94  | 251.38       | EEU-FM1A332        |
|            | 3900             | 12.5            | 30   | 5.0 | 0.8      | 390.0   | 0.013  | 3630   | 7000              | P12736-ND         | 1.09    | 37.39 | 64.71  | 244.47       | EEU-FM1A392L       |
| 3900       | 16               | 20              | 7.5  | 0.8 | 390.0    | 0.017   | 3300   | 5000   | P12737-ND         | 1.31              | 44.88   | 77.66 | 293.40 | EEU-FM1A392S |                    |
| 4700       | 12.5             | 35              | 5.0  | 0.8 | 470.0    | 0.012   | 3750   | 7000   | P12362-ND         | 1.60              | 54.94   | 95.09 | 359.21 | EEU-FM1A472L |                    |
| 5600       | 16               | 25              | 7.5  | 0.8 | 560.0    | 0.014   | 3820   | 7000   | P12363-ND         | 1.56              | 53.40   | 92.43 | 349.20 | EEU-FM1A562  |                    |
| 16         | 68               | 5               | 11   | 2.0 | 0.5      | 10.9  | 0.300  | 280  | 2000              | P12921-ND         | .35     | 8.03  | 13.66  | 48.21        | EEU-FM1C680        |
|            | 120              | 6               | 11.2 | 2.5 | 0.5      | 19.2  | 0.130  | 455  | 2000              | P12922-ND         | .36     | 8.90  | 15.08  | 56.56        | EEU-FM1C121        |
|            | 330              | 8               | 11.5 | 3.5 | 0.6      | 52.8  | 0.056  | 950  | 3000              | P12372-ND         | .50     | 12.23 | 20.97  | 78.65        | EEU-FM1C331        |
|            | 470              | 10              | 12.5 | 5.0 | 0.6      | 75.2  | 0.038  | 1290   | 4000              | P12375-ND         | .57     | 15.28 | 26.63  | 98.64        | EEU-FM1C471        |
|            | 470              | 8               | 15   | 3.5 | 0.6      | 75.2  | 0.041  | 1240   | 3000              | P12376-ND         | .56     | 15.12 | 26.33  | 97.52        | EEU-FM1C471L       |
|            | 680              | 10              | 16   | 5.0 | 0.6      | 108.8   | 0.026  | 1790   | 4000              | P12377-ND         | .76     | 20.39 | 35.51  | 131.52       | EEU-FM1C681        |
|            | 680              | 8               | 20   | 3.5 | 0.6      | 108.8   | 0.030  | 1560   | 4000              | P12378-ND         | .66     | 17.65 | 30.76  | 113.90       | EEU-FM1C681L       |
|            | 1000             | 10              | 20   | 5.0 | 0.6      | 160.0   | 0.019  | 2180   | 5000              | P12366-ND         | .75     | 22.08 | 37.86  | 149.89       | EEU-FM1C102        |
|            | 1200             | 10              | 25   | 5.0 | 0.6      | 192.0   | 0.018  | 2470   | 5000              | P12367-ND         | .84     | 24.83 | 42.57  | 168.55       | EEU-FM1C122L       |
|            | 1500             | 12.5            | 20   | 5.0 | 0.6      | 240.0   | 0.018  | 2600   | 5000              | P12368-ND         | .95     | 29.96 | 51.61  | 199.77       | EEU-FM1C152        |
|            | 2200             | 12.5            | 25   | 5.0 | 0.6      | 352.0   | 0.015  | 3190   | 7000              | P12369-ND         | 1.19    | 37.70 | 64.94  | 251.38       | EEU-FM1C222        |
|            | 2700             | 12.5            | 30   | 5.0 | 0.8      | 432.0   | 0.013  | 3630   | 7000              | P12370-ND         | 1.09    | 37.39 | 64.71  | 244.47       | EEU-FM1C272L       |
| 2700       | 16               | 20              | 7.5  | 0.8 | 432.0    | 0.017   | 3300   | 5000   | P12371-ND         | 1.31              | 44.88   | 77.66 | 293.40 | EEU-FM1C272S |                    |
| 3300       | 12.5             | 35              | 5.0  | 0.8 | 528.0    | 0.012   | 3750   | 7000   | P12373-ND         | 1.60              | 54.94   | 95.09 | 359.21 | EEU-FM1C332L |                    |
| 3900       | 16               | 25              | 7.5  | 0.8 | 624.0    | 0.014   | 3820   | 7000   | P12374-ND         | 1.56              | 53.40   | 92.43 | 349.20 | EEU-FM1C392  |                    |
| 25         | 47               | 5               | 11   | 2.0 | 0.5      | 11.8  | 0.300  | 280  | 2000              | P12923-ND         | .35     | 8.03  | 13.66  | 48.21        | EEU-FM1E470        |
|            | 100              | 6               | 11.2 | 2.5 | 0.5      | 25.0  | 0.130  | 455  | 2000              | P12924-ND         | .36     | 8.90  | 15.08  | 56.56        | EEU-FM1E101        |
|            | 220              | 8               | 11.5 | 3.5 | 0.6      | 55.0  | 0.056  | 950  | 3000              | P12383-ND         | .50     | 12.23 | 20.97  | 78.65        | EEU-FM1E221        |
|            | 330              | 10              | 12.5 | 5.0 | 0.6      | 82.5  | 0.038  | 1290   | 4000              | P12386-ND         | .57     | 15.28 | 26.63  | 98.64        | EEU-FM1E331        |
|            | 330              | 8               | 15   | 3.5 | 0.6      | 82.5  | 0.041  | 1240   | 3000              | P12387-ND         | .56     | 15.12 | 26.33  | 97.52        | EEU-FM1E331L       |
|            | 470              | 10              | 16   | 5.0 | 0.6      | 117.5   | 0.026  | 1790   | 4000              | P12388-ND         | .76     | 20.39 | 35.51  | 131.52       | EEU-FM1E471        |
|            | 470              | 8               | 20   | 3.5 | 0.6      | 117.5   | 0.030  | 1560   | 4000              | P12389-ND         | .66     | 17.65 | 30.76  | 113.90       | EEU-FM1E471L       |
|            | 680              | 10              | 20   | 5.0 | 0.6      | 170.0   | 0.019  | 2180   | 5000              | P12390-ND         | .75     | 22.08 | 37.86  | 149.89       | EEU-FM1E681        |
|            | 820              | 10              | 25   | 5.0 | 0.6      | 205.0   | 0.018  | 2470   | 5000              | P12391-ND         | .84     | 24.83 | 42.57  | 168.55       | EEU-FM1E821L       |
|            | 1000             | 12.5            | 20   | 5.0 | 0.6      | 250.0   | 0.018  | 2600   | 5000              | P12379-ND         | .95     | 29.96 | 51.61  | 199.77       | EEU-FM1E102        |
|            | 1500             | 12.5            | 25   | 5.0 | 0.6      | 375.0   | 0.015  | 3190   | 7000              | P12380-ND         | 1.19    | 37.70 | 64.94  | 251.38       | EEU-FM1E152        |
|            | 1800             | 12.5            | 30   | 5.0 | 0.8      | 450.0   | 0.013  | 3630   | 7000              | P12381-ND         | 1.09    | 37.39 | 64.71  | 244.47       | EEU-FM1E182L       |
| 1800       | 16               | 20              | 7.5  | 0.8 | 450.0    | 0.017   | 3300   | 5000   | P12382-ND         | 1.31              | 44.88   | 77.66 | 293.40 | EEU-FM1E182S |                    |
| 2200       | 12.5             | 35              | 5.0  | 0.8 | 550.0    | 0.012   | 3750   | 7000   | P12384-ND         | 1.60              | 54.94   | 95.09 | 359.21 | EEU-FM1E222L |                    |
| 2700       | 16               | 25              | 7.5  | 0.8 | 675.0    | 0.014   | 3820   | 7000   | P12385-ND         | 1.56              | 53.40   | 92.43 | 349.20 | EEU-FM1E272  |                    |
| 35         | 33               | 5               | 11   | 2.0 | 0.5      | 11.6  | 0.300  | 280  | 2000              | P12925-ND         | .35     | 8.03  | 13.66  | 48.21        | EEU-FM1V330        |
|            | 68               | 6               | 11.2 | 2.5 | 0.5      | 23.8  | 0.130  | 455  | 2000              | P12926-ND         | .36     | 8.90  | 15.08  | 56.56        | EEU-FM1V680        |
|            | 150              | 8               | 11.5 | 3.5 | 0.6      | 52.5  | 0.056  | 950  | 3000              | P12408-ND         | .50     | 12.23 | 20.97  | 78.65        | EEU-FM1V151        |
|            | 220              | 10              | 12.5 | 5.0 | 0.6      | 77.0  | 0.038  | 1290   | 4000              | P12411-ND         | .57     | 15.28 | 26.63  | 98.64        | EEU-FM1V221        |
|            | 220              | 8               | 15   | 3.5 | 0.6      | 77.0  | 0.041  | 1240   | 3000              | P12412-ND         | .56     | 15.12 | 26.33  | 97.52        | EEU-FM1V221L       |
|            | 330              | 10              | 16   | 5.0 | 0.6      | 115.5   | 0.026  | 1790   | 4000              | P12413-ND         | .76     | 20.39 | 35.51  | 131.52       | EEU-FM1V331        |
|            | 330              | 8               | 20   | 3.5 | 0.6      | 115.5   | 0.030  | 1560   | 4000              | P12414-ND         | .66     | 17.65 | 30.76  | 113.90       | EEU-FM1V331L       |
|            | 470              | 10              | 20   | 5.0 | 0.6      | 164.5   | 0.019  | 2180   | 5000              | P12415-ND         | .75     | 22.08 | 37.86  | 149.89       | EEU-FM1V471        |
|            | 560              | 10              | 25   | 5.0 |          |   |  |  |                   |                   |         |       |        |              |                    |