

# TF Series

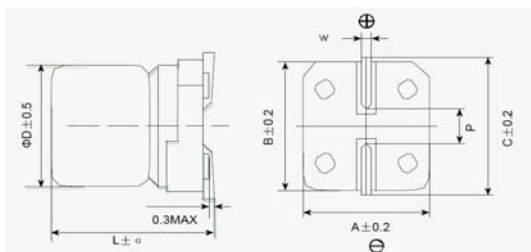
- Suitable for high density mounting
- Endurance: 105°C 6000 hours
- RoHS Compliant



## ● SPECIFICATIONS

| Items  | Characteristics   |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
|--|---|--------------------------------------|------|------|------|------|--------------------------------|--------------------------------------|------|------|------------|------------|------------------|
| Category Temperature Range                             | -40 to +105°C   |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
| Rated Voltage Range                                    | 6.3 to 450Vdc   |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
| Capacitance Tolerance                                  | ±20% (M) (at 20°C, 120Hz)   |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
| Leakage Current  | 6.3 to 100 Vdc  |                                      |      |      |      |      | 160 to 450 Vdc                 |                                      |      |      |            |            | (at 20°C)        |
|  | I ≅ 0.03CV or 4uA Whichever is greater (at 2 minutes)   |                                      |      |      |      |      | I ≅ 0.04CV+100uA (at 1 minute) |                                      |      |      |            |            |                  |
|  | Where, I: Max. leakage current (uA); C: Nominal capacitance (uF); V: Rated voltage (V).   |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
| Dissipation (tan δ)                                    | Rate voltage (Vdc)  | 6.3                                  | 10   | 16   | 25   | 35   | 50                             | 63                                   | 80   | 100  | 160 to 250 | 400 to 450 | (at 20°C, 120Hz) |
|  | Tan δ (Max)   | 0.32                                 | 0.28 | 0.26 | 0.16 | 0.14 | 0.14                           | 0.12                                 | 0.12 | 0.10 | 0.20       | 0.24       |                  |
| Low Temperature Characteristics (Max. Impedance Ratio) | Rate voltage (Vdc)  | 6.3                                  | 10   | 16   | 25   | 35   | 50                             | 63                                   | 80   | 100  | 160 to 250 | 400 to 450 | (at 120Hz)       |
|  | Z(-25°C)/Z(+20°C)   | 4                                    | 3    | 2    | 2    | 2    | 2                              | 2                                    | 2    | 2    | 6          | 6          |                  |
|  | Z(-40°C)/Z(+20°C)   | 10                                   | 8    | 6    | 4    | 3    | 3                              | 3                                    | 3    | 3    | 10         | 18         |                  |
| Endurance  | The following specification shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 6000 hours at 105°C.           |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
|  | Rate voltage (Vdc)  | 6.3 to 100V                          |      |      |      |      |                                | 160 to 450V                          |      |      |            |            |                  |
|  | Capacitance Change  | ≤±30% of the initial value           |      |      |      |      |                                | ≤±20% of the initial value           |      |      |            |            |                  |
|  | D. F. (tan δ)   | ≤300% of the initial specified value |      |      |      |      |                                | ≤200% of the initial specified value |      |      |            |            |                  |
|  | Leakage Current   | ≤the initial specified value         |      |      |      |      |                                | ≤the initial specified value         |      |      |            |            |                  |
| Shelf Life   | The following specification shall be satisfied when the capacitors are restored to 20°C after exposing them for 1000 hours at 105°C, without voltage applied. |                                      |      |      |      |      |                                |                                      |      |      |            |            |                  |
|  | Rate voltage (Vdc)  | 6.3 to 100V                          |      |      |      |      |                                | 160 to 450V                          |      |      |            |            |                  |
|  | Capacitance Change  | ≤±30% of the initial value           |      |      |      |      |                                | ≤±20% of the initial value           |      |      |            |            |                  |
|  | D. F. (tan δ)   | ≤300% of the initial specified value |      |      |      |      |                                | ≤200% of the initial specified value |      |      |            |            |                  |
|  | Leakage Current   | ≤200% of the initial specified value |      |      |      |      |                                | ≤200% of the initial specified value |      |      |            |            |                  |

## ◆ DIMENSIONS (mm)



| Size code | D    | L    | A    | B    | C    | W       | P   |
|-----------|------|------|------|------|------|---------|-----|
| 0508      | 5    | 7.7  | 5.3  | 5.3  | 5.9  | 0.5~0.8 | 1.4 |
| 0608      | 6.3  | 7.7  | 6.6  | 6.6  | 7.2  | 0.5~0.8 | 1.9 |
| 0609      | 6.3  | 8.7  | 6.6  | 6.6  | 7.2  | 0.5~0.8 | 1.9 |
| 0810      | 8    | 10.5 | 8.3  | 8.3  | 9.0  | 0.7~1.1 | 3.1 |
| 0812      | 8    | 12.5 | 8.3  | 8.3  | 9.0  | 0.7~1.1 | 3.1 |
| 1010      | 10   | 10.5 | 10.3 | 10.3 | 11.0 | 0.7~1.1 | 4.5 |
| 1012      | 10   | 12.5 | 10.3 | 10.3 | 11.0 | 0.7~1.1 | 4.5 |
| 1214      | 12.5 | 13.5 | 13.0 | 13.0 | 13.7 | 1.0~1.3 | 4.2 |
| 1216      | 12.5 | 16.0 | 13.0 | 13.0 | 13.7 | 1.0~1.3 | 4.2 |
| 1616      | 16   | 16.5 | 17.0 | 17.0 | 18.0 | 1.0~1.3 | 6.5 |
| 1621      | 16   | 21.5 | 17.0 | 17.0 | 18.0 | 1.0~1.3 | 6.5 |
| 1816      | 18   | 16.5 | 19.0 | 19.0 | 20.0 | 1.0~1.3 | 6.5 |
| 1821      | 18   | 21.5 | 19.0 | 19.0 | 20.0 | 1.0~1.3 | 6.5 |

## ◆ RATED RIPPLE CURRENT MULTIPLIERS

| Freq. (Hz) | 120  | 1K   | 10K  | 100K |
|------------|------|------|------|------|
| WV (Vdc)   |      |      |      |      |
| 6.3 to 450 | 0.50 | 0.80 | 0.90 | 1.00 |

# TF Series

## ◆ STANDARD RATINGS

| WV (Vdc) | Cap (uF) | Size code | tan $\delta$ | Ripple current (mArms/105°C, 100KHz) |
|----------|----------|-----------|--------------|--------------------------------------|
| 6.3 (0J) | 47       | 0508      | 0.32         | 90                                   |
|          | 100      | 0608      | 0.32         | 145                                  |
|          | 220      | 0608      | 0.32         | 180                                  |
|          | 330      | 0810      | 0.32         | 280                                  |
|          | 470      | 0810      | 0.32         | 360                                  |
| 10 (1A)  | 33       | 0508      | 0.28         | 71                                   |
|          | 150      | 0608      | 0.28         | 105                                  |
|          | 220      | 0810      | 0.28         | 280                                  |
|          | 330      | 1010      | 0.28         | 400                                  |
|          | 470      | 1010      | 0.28         | 545                                  |
| 16 (1C)  | 47       | 0508      | 0.26         | 90                                   |
|          | 100      | 0608      | 0.26         | 145                                  |
|          | 220      | 0810      | 0.26         | 475                                  |
|          | 330      | 0812      | 0.26         | 510                                  |
|          | 470      | 1010      | 0.26         | 720                                  |
| 25 (1E)  | 33       | 0508      | 0.16         | 90                                   |
|          | 47       | 0608      | 0.16         | 165                                  |
|          | 100      | 0608      | 0.16         | 175                                  |
|          | 220      | 0810      | 0.16         | 535                                  |
|          | 330      | 1010      | 0.16         | 750                                  |
| 35 (1V)  | 10       | 0508      | 0.14         | 90                                   |
|          | 10       | 0608      | 0.14         | 145                                  |
|          | 22       | 0508      | 0.14         | 96                                   |
|          | 22       | 0608      | 0.14         | 160                                  |
|          | 33       | 0609      | 0.14         | 175                                  |
|          | 47       | 0609      | 0.14         | 190                                  |
|          | 100      | 0810      | 0.14         | 560                                  |
|          | 220      | 1010      | 0.14         | 800                                  |
|          |          |           |              |                                      |
| 50 (1H)  | 10       | 0508      | 0.14         | 86                                   |
|          | 22       | 0608      | 0.14         | 145                                  |
|          | 47       | 0810      | 0.14         | 520                                  |
|          | 100      | 1010      | 0.14         | 680                                  |
|          | 220      | 1214      | 0.14         | 875                                  |
|          | 330      | 1216      | 0.14         | 1050                                 |
| 63 (1J)  | 22       | 0608      | 0.12         | 140                                  |
|          | 33       | 0810      | 0.12         | 320                                  |
|          | 47       | 0810      | 0.12         | 380                                  |
|          | 100      | 1010      | 0.12         | 530                                  |
|          | 220      | 1214      | 0.12         | 840                                  |
|          | 330      | 1616      | 0.12         | 1040                                 |
|          | 470      | 1621      | 0.12         | 1700                                 |
| 80 (1K)  | 10       | 0608      | 0.12         | 130                                  |
|          | 22       | 0810      | 0.12         | 360                                  |
|          | 33       | 0810      | 0.12         | 410                                  |
|          | 47       | 1010      | 0.12         | 490                                  |
|          | 100      | 1012      | 0.12         | 530                                  |
|          | 220      | 1216      | 0.12         | 1020                                 |
| 100 (2A) | 10       | 0810      | 0.10         | 290                                  |
|          | 22       | 0810      | 0.10         | 320                                  |
|          | 33       | 1010      | 0.10         | 360                                  |
|          | 47       | 1010      | 0.10         | 540                                  |
|          | 100      | 1214      | 0.10         | 550                                  |
|          | 220      | 1616      | 0.10         | 1090                                 |

| WV (Vdc) | Cap (uF) | Size code | tan $\delta$ | Ripple current (mArms/105°C, 100KHz) |  |
|----------|----------|-----------|--------------|--------------------------------------|--|
| 160 (2C) | 10       | 1010      | 0.20         | 176                                  |  |
|          | 15       | 1214      | 0.20         | 240                                  |  |
|          | 22       | 1216      | 0.20         | 340                                  |  |
|          | 33       | 1616      | 0.20         | 440                                  |  |
|          | 47       | 1616      | 0.20         | 500                                  |  |
|          | 68       | 1621      | 0.20         | 620                                  |  |
|          | 100      | 1821      | 0.20         | 760                                  |  |
|          |          |           |              |                                      |  |
| 200 (2D) | 10       | 1214      | 0.20         | 200                                  |  |
|          | 15       | 1214      | 0.20         | 240                                  |  |
|          | 22       | 1216      | 0.20         | 340                                  |  |
|          | 33       | 1616      | 0.20         | 440                                  |  |
|          | 33       | 1621      | 0.20         | 460                                  |  |
|          | 47       | 1621      | 0.20         | 540                                  |  |
|          | 47       | 1821      | 0.20         | 580                                  |  |
|          | 68       | 1821      | 0.20         | 680                                  |  |
| 250 (2E) | 4.7      | 1010      | 0.20         | 90                                   |  |
|          | 10       | 1214      | 0.20         | 200                                  |  |
|          | 15       | 1216      | 0.20         | 260                                  |  |
|          | 22       | 1216      | 0.20         | 360                                  |  |
|          | 33       | 1816      | 0.20         | 500                                  |  |
|          | 47       | 1621      | 0.20         | 570                                  |  |
|          | 47       | 1821      | 0.20         | 610                                  |  |
|          | 56       | 1821      | 0.20         | 660                                  |  |
| 400 (2G) | 2.2      | 1010      | 0.24         | 60                                   |  |
|          | 3.3      | 1010      | 0.24         | 80                                   |  |
|          | 3.9      | 1214      | 0.24         | 100                                  |  |
|          | 4.7      | 1214      | 0.24         | 110                                  |  |
|          | 6.8      | 1214      | 0.24         | 150                                  |  |
|          | 10       | 1216      | 0.24         | 240                                  |  |
|          | 15       | 1621      | 0.24         | 300                                  |  |
| 450 (2W) | 2.2      | 1010      | 0.24         | 60                                   |  |
|          | 3.3      | 1214      | 0.24         | 90                                   |  |
|          | 4.7      | 1216      | 0.24         | 120                                  |  |
|          | 10       | 1616      | 0.24         | 240                                  |  |
|          | 15       | 1621      | 0.24         | 300                                  |  |
|          |          |           |              |                                      |  |
|          | 22       | 1821      | 0.24         | 400                                  |  |