# DC Film Capacitors
# MKT Radial Potted Type


## FEATURES

- AEC-Q200 qualified (rev. D) for PCM ≤ 27.5 mm up to 125 °C (for larger available components on request)
- High temperature capabilities, up to 150 °C
- Capacitance up to 560 µF
- 4-pin version available under request for pitch ≥ 37.5 mm, under request
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE Available

Pb-free

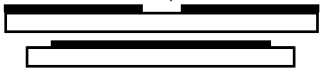
RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

## APPLICATIONS

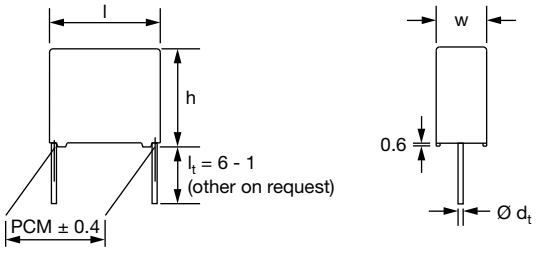
- Automotive
- DC filtering
- Low voltage DC link

| QUICK REFERENCE DATA | |
|---|---|
| Capacitance range | 1000 pF to 560 µF |
| Capacitance tolerance | ± 20 %, ± 10 %, ± 5 % |
| Climatic testing class according to IEC 60068-1 | 55/125/56 |
| Maximum application temperature | 125 °C |
| Reference standards | IEC 60384-2 |
| Dielectric | Polyester film |
| Electrodes | Metallized |
| Construction | Mono construction<br>  <br>Series construction (630 V and 1000 V)<br>  |
| Encapsulation | Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0 |
| Leads | Tinned wire |
| Marking | C-value; tolerance; rated voltage; code for dielectric material; code for manufacturing origin; manufacturer's type designation; manufacturer's logo or name; year and week of manufacture |
| Rated (DC) voltage | 63 $V_{DC}$, 100 $V_{DC}$, 160 $V_{DC}$, 250 $V_{DC}$, 400 $V_{DC}$, 630 $V_{DC}$, 1000 $V_{DC}$ |
| Rated (AC) voltage | 40 $V_{AC}$, 63 $V_{AC}$, 160 $V_{AC}$, 200 $V_{AC}$, 220 $V_{AC}$ |
| Maximum operating temperature for limited time | 150 °C at 0.3 $U_R$ for maximum 200 h<br>(not applicable for pitch ≥ 37.5 mm) |

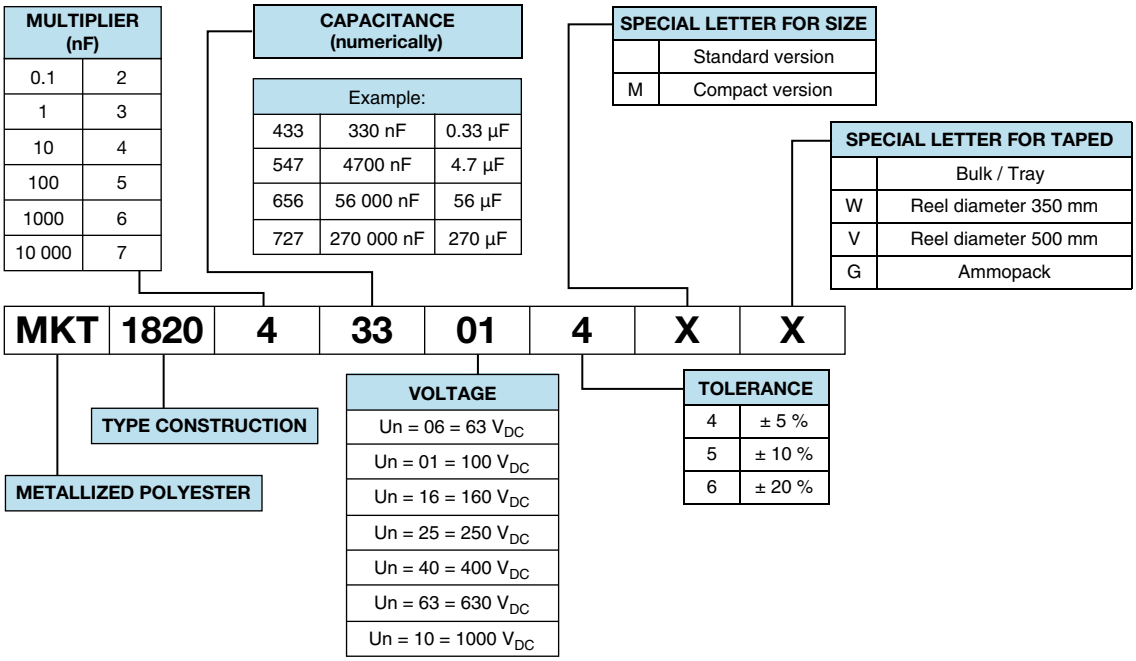
**Note**

- For more detailed data and test requirements, contact dc-film@vishay.com

## DIMENSIONS in millimeters



## COMPOSITION OF CATALOG NUMBER




**Notes**

- For detailed tape specifications refer to packaging information www.vishay.com/doc?28139 or end of catalog
- For PCM ≥ 37.5 mm, 4 pin versions are available under customer request

## SPECIFIC REFERENCE DATA

| DESCRIPTION | VALUE | | | |
|---|---|---|---|---|
| Tangent of loss angle: | at 100 Hz | at 1 kHz | at 10 kHz | at 100 kHz |
| C ≤ 0.1 µF | - | ≤ 80 x $10^{-4}$ | ≤ 150 x $10^{-4}$ | ≤ 250 x $10^{-4}$ |
| 0.1 µF < C ≤ 1.0 µF | - | ≤ 80 x $10^{-4}$ | ≤ 150 x $10^{-4}$ | - |
| 1.0 µF < C ≤ 10.0 µF | ≤ 35 x $10^{-4}$ | ≤ 150 x $10^{-4}$ | - | - |
| 10.0 µF < C ≤ 100 µF | ≤ 50 x $10^{-4}$ | ≤ 300 x $10^{-4}$ | - | - |
| C > 100 µF | ≤ 70 x $10^{-4}$ | - | - | - |

| PITCH (mm) | MAXIMUM PULSE RISE TIME $(dU/dt)_R$ [V/µs] | | | | | | |
|---|---|---|---|---|---|---|---|
| | 63 $V_{DC}$ | 100 $V_{DC}$ | 160 $V_{DC}$ | 250 $V_{DC}$ | 400 $V_{DC}$ | 630 $V_{DC}$ | 1000 $V_{DC}$ |
| 10 | 12 | 18 | - | 36 | 52 | 70 | 260 |
| 15 | 8 | 10 | - | 20 | 32 | 66 | 130 |
| 22.5 | 5 | 6 | - | 12 | 18 | 38 | 68 |
| 27.5 | 3 | 5 | 6 | 8 | 14 | 28 | 50 |
| 37.5 | 0.8 | 1 | 2 | 3 | - | - | - |
| 52.5 | 0.2 | 0.3 | 0.4 | 1 | - | - | - |

If the maximum pulse voltage is less than the rated voltage higher dU/dt values can be permitted.

| | | |
|---|---|---|
| R between leads, for C ≤ 0.33 µF and $U_R$ ≤ 100 V | | > 15 000 MΩ |
| R between leads, for C ≤ 0.33 µF and $U_R$ > 100 V | | > 30 000 MΩ |
| RC between leads, for C > 0.33 µF and $U_R$ ≤ 100 V | | > 5000 s |
| RC between leads, for C > 0.33 µF and $U_R$ > 100 V | | > 10 000 s |
| R between leads and case, 100 V; (foil method) | | > 30 000 MΩ |
| Withstanding (DC) voltage (cut off current 10 mA) (1); rise time < 1000 V/s | | 1.6 x $U_{RDC}$, 1 min |
| Withstanding (DC) leads and case | | 2 x $U_{RDC}$, 1 min |
| Maximum application temperature | | 125 °C |

**Note**

(1) See “Voltage Proof Test for Metalized Film Capacitors”: www.vishay.com/doc?28169

## ELECTRICAL DATA

| $U_{RDC}$ (V) | CAP. (µF) | CAPACITANCE CODE | VOLTAGE CODE | $V_{AC}$ | DIMENSIONS w x h x l (mm) [1] | PCM (mm) | $d_t$ ± 0.08 mm (mm) | ORDERING CODE FOR 10 % TOL./BULK PACKING [2] |
|---|---|---|---|---|---|---|---|---|
| 63 | 0.22 | 422 | 06 | 40 | 3.5 x 8.0 x 13.0 | 10.0 | 0.80 | MKT1820422065 |
| | 0.33 | 433 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820433065 |
| | 0.47 | 447 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820447065 |
| | 0.68 | 468 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820468065 |
| | 1.0 | 510 | | | 4.5 x 9.5 x 13.0 | 10.0 | | MKT1820510065 |
| | 1.5 | 515 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820515065 |
| | 2.2 | 522 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820522065 |
| | 3.3 | 533 | | | 9.0 x 15.5 x 13.0 | 10.0 | | MKT1820533065M |
| | 3.3 | 533 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820533065 |
| | 4.7 | 547 | | | 9.0 x 15.5 x 13.0 | 10.0 | | MKT1820547065M |
| | 4.7 | 547 | | | 7.5 x 13.5 x 18.0 | 15.0 | | MKT1820547065 |
| | 6.8 | 568 | | | 8.5 x 14.5 x 18.0 | 15.0 | | MKT1820568065 |
| | 10.0 | 610 | | | 8.5 x 17.5 x 18.0 | 15.0 | | MKT1820610065 |
| | 15.0 | 615 | | | 8.5 x 16.5 x 26.5 | 22.5 | | MKT1820615065 |
| | 22.0 | 622 | | | 10.5 x 18.5 x 26.5 | 22.5 | | MKT1820622065M |
| | 18.0 | 618 | | | 9.0 x 19.0 x 32.0 | 27.5 | | MKT1820618065 |
| | 22.0 | 622 | | | 11.0 x 21.0 x 32.0 | 27.5 | | MKT1820622065 |
| | 27.0 | 627 | | | 11.0 x 21.0 x 32.0 | 27.5 | | MKT1820627065 |
| | 33.0 | 633 | | | 13.0 x 23.0 x 32.0 | 27.5 | | MKT1820633065 |
| | 39.0 | 639 | | | 13.0 x 23.0 x 32.0 | 27.5 | | MKT1820639065 |
| | 47.0 | 647 | | | 15.0 x 25.0 x 32.0 | 27.5 | | MKT1820647065 |
| | 56.0 | 656 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820656065 |
| | 68.0 | 668 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820668065 |
| | 82.0 | 682 | | | 21.0 x 31.0 x 32.0 | 27.5 | | MKT1820682065 |
| | 100.0 | 710 | | | 21.0 x 31.0 x 32.0 | 27.5 | | MKT1820710065M |
| | 100.0 | 710 | | | 18.5 x 35.5 x 43.0 | 37.5 | 1.0 | MKT1820710065 |
| | 120.0 | 712 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820712065 |
| | 150.0 | 715 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820715065 |
| | 180.0 | 718 | | | 21.5 x 38.5 x 42.0 | 37.5 | | MKT1820718065 |
| | 220.0 | 722 | | | 24.0 x 44.0 x 42.0 | 37.5 | | MKT1820722065M |
| | 270.0 | 727 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820727065M |
| | 330.0 | 733 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820733065M |
| | 220.0 | 722 | | | 25.0 x 45.0 x 57.5 | 52.5 | 1.2 | MKT1820722065 |
| | 270.0 | 727 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820727065 |
| | 330.0 | 733 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820733065 |
| | 390.0 | 739 | | | 30.0 x 45.0 x 57.5 | 52.5 | | MKT1820739065 |
| | 470.0 | 747 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820747065 |
| | 560.0 | 756 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820756065 |

**Notes**

[1] For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

[2] Please replace “5” by: “4” for 5 % tolerance or “6” for 20 % tolerance

## ELECTRICAL DATA

| $U_{RDC}$ (V) | CAP. (µF) | CAPACITANCE CODE | VOLTAGE CODE | $V_{AC}$ | DIMENSIONS w x h x l (mm) (1) | PCM (mm) | $d_t$ ± 0.08 mm (mm) | ORDERING CODE FOR 10 % TOL./BULK PACKING (2) |
|---|---|---|---|---|---|---|---|---|
| 100 | 0.068 | 368 | 01 | 63 | 3.5 x 8.0 x 13.0 | 10.0 | 0.8 | MKT1820368015 |
| | 0.10 | 410 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820410015 |
| | 0.15 | 415 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820415015 |
| | 0.22 | 422 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820422015 |
| | 0.33 | 433 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820433015 |
| | 0.47 | 447 | | | 4.5 x 9.5 x 13.0 | 10.0 | | MKT1820447015 |
| | 0.68 | 468 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820468015 |
| | 1.0 | 510 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820510015M |
| | 1.0 | 510 | | | 5.5 x 10.5 x 18.0 | 15.0 | | MKT1820510015 |
| | 1.5 | 515 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820515015 |
| | 2.2 | 522 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820522015 |
| | 3.3 | 533 | | | 8.5 x 14.5 x 18.0 | 15.0 | | MKT1820533015 |
| | 4.7 | 547 | | | 8.5 x 14.5 x 18.0 | 15.0 | | MKT1820547015M |
| | 4.7 | 547 | | | 7.5 x 15.5 x 26.5 | 22.5 | | MKT1820547015 |
| | 6.8 | 568 | | | 8.5 x 16.5 x 26.5 | 22.5 | | MKT1820568015 |
| | 10.0 | 610 | | | 10.5 x 18.5 x 26.5 | 22.5 | | MKT1820610015 |
| | 15.0 | 615 | | | 10.5 x 18.5 x 26.5 | 22.5 | | MKT1820615015M |
| | 15.0 | 615 | | | 11.0 x 21.0 x 32.0 | 27.5 | | MKT1820615015 |
| | 18.0 | 618 | | | 13.0 x 23.0 x 32.0 | 27.5 | | MKT1820618015 |
| | 22.0 | 622 | | | 13.0 x 23.0 x 32.0 | 27.5 | | MKT1820622015 |
| | 27.0 | 627 | | | 15.0 x 25.0 x 32.0 | 27.5 | | MKT1820627015 |
| | 33.0 | 633 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820633015 |
| | 39.0 | 639 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820639015 |
| | 47.0 | 647 | | | 21.0 x 31.0 x 32.0 | 27.5 | | MKT1820647015 |
| | 56.0 | 656 | | | 21.0 x 31.0 x 32.0 | 27.5 | | MKT1820656015M |
| | 56.0 | 656 | | | 18.5 x 35.5 x 43.0 | 37.5 | 1.0 | MKT1820656015 |
| | 68.0 | 668 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820668015 |
| | 82.0 | 682 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820682015 |
| | 100.0 | 710 | | | 21.5 x 38.5 x 42.0 | 37.5 | | MKT1820710015 |
| | 120.0 | 712 | | | 24.0 x 44.0 x 42.0 | 37.5 | | MKT1820712015M |
| | 150.0 | 715 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820715015M |
| | 180.0 | 718 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820718015M |
| | 120.0 | 712 | | | 25.0 x 45.0 x 57.5 | 52.5 | 1.2 | MKT1820712015 |
| | 150.0 | 715 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820715015 |
| | 180.0 | 718 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820718015 |
| | 220.0 | 722 | | | 30.0 x 45.0 x 57.5 | 52.5 | | MKT1820722015 |
| | 270.0 | 727 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820727015 |
| | 330.0 | 733 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820733015 |

**Notes**

(1) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

(2) Please replace “5” by: “4” for 5 % tolerance or “6” for 20 % tolerance

## ELECTRICAL DATA

| $U_{RDC}$ (V) | CAP. (µF) | CAPACITANCE CODE | VOLTAGE CODE | $V_{AC}$ | DIMENSIONS w x h x l (mm) [1] | PCM (mm) | $d_t$ ± 0.08 mm (mm) | ORDERING CODE FOR 10 % TOL./BULK PACKING [2] |
|---|---|---|---|---|---|---|---|---|
| 160 | 4.7 | 547 | 16 | 63 | 9.0 x 19.0 x 32.0 | 27.5 | 0.8 | MKT1820547165 |
| | 6.8 | 568 | | | 11.0 x 21.0 x 32.0 | 27.5 | | MKT1820568165 |
| | 10.0 | 610 | | | 11.0 x 21.0 x 32.0 | 27.5 | | MKT1820610165 |
| | 15.0 | 615 | | | 13.0 x 23.0 x 32.0 | 27.5 | | MKT1820615165 |
| | 18.0 | 618 | | | 15.0 x 25.0 x 32.0 | 27.5 | | MKT1820618165 |
| | 22.0 | 622 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820622165 |
| | 27.0 | 627 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820627165 |
| | 33.0 | 633 | | | 31.0 x 31.0 x 32.0 | 27.5 | | MKT1820633165M |
| | 33.0 | 633 | | | 18.5 x 35.5 x 43.0 | 37.5 | 1.0 | MKT1820633165 |
| | 39.0 | 639 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820639165 |
| | 47.0 | 647 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820647165 |
| | 56.0 | 656 | | | 21.5 x 38.5 x 42.0 | 37.5 | | MKT1820656165 |
| | 68.0 | 668 | | | 21.5 x 38.5 x 42.0 | 37.5 | | MKT1820668165 |
| | 82.0 | 682 | | | 24.0 x 44.0 x 42.0 | 37.5 | | MKT1820682165M |
| | 100.0 | 710 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820710165M |
| | 120.0 | 712 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820712165M |
| | 82.0 | 682 | | | 25.0 x 45.0 x 57.5 | 52.5 | 1.2 | MKT1820682165 |
| | 100.0 | 710 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820710165 |
| | 120.0 | 712 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820712165 |
| | 150.0 | 715 | | | 30.0 x 45.0 x 57.5 | 52.5 | | MKT1820715165 |
| | 180.0 | 718 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820718165 |
| | 220.0 | 722 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820722165 |
| 250 | 0.022 | 322 | 25 | 160 | 3.5 x 8.0 x 13.0 | 10.0 | 0.8 | MKT1820322255 |
| | 0.033 | 333 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820333255 |
| | 0.047 | 347 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820347255 |
| | 0.068 | 368 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820368255 |
| | 0.10 | 410 | | | 4.5 x 9.5 x 13.0 | 10.0 | | MKT1820410255 |
| | 0.15 | 415 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820415255 |
| | 0.22 | 422 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820422255 |
| | 0.33 | 433 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820433255M |
| | 0.33 | 433 | | | 5.5 x 10.5 x 18.0 | 15.0 | | MKT1820433255 |
| | 0.47 | 447 | | | 9.0 x 15.5 x 13.0 | 10.0 | | MKT1820447255M |
| | 0.47 | 447 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820447255 |
| | 0.68 | 468 | | | 7.5 x 13.5 x 18.0 | 15.0 | | MKT1820468255 |
| | 1.0 | 510 | | | 8.5 x 14.5 x 18.0 | 15.0 | | MKT1820510255 |
| | 1.5 | 515 | | | 10.5 x 17,5 x 18.0 | 15.0 | | MKT1820515255M |
| | 1.5 | 515 | | | 8.5 x 16.5 x 26.5 | 22.5 | | MKT1820515255 |
| | 2.2 | 522 | | | 10.5 x 18.5 x 26.5 | 22.5 | | MKT1820522255 |
| | 3.3 | 533 | | | 12.5 x 20.0 x 26.5 | 22.5 | | MKT1820533255 |

**Notes**

[1] For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

[2] Please replace “5” by: “4” for 5 % tolerance or “6” for 20 % tolerance

## ELECTRICAL DATA

| $U_{RDC}$ (V) | CAP. (µF) | CAPACITANCE CODE | VOLTAGE CODE | $V_{AC}$ | DIMENSIONS w x h x l (mm) (1) | PCM (mm) | $d_t$ ± 0.08 mm (mm) | ORDERING CODE FOR 10 % TOL./BULK PACKING (2) |
|---|---|---|---|---|---|---|---|---|
| 250 | 4.7 | 547 | 25 | 100 | 11.0 x 21.0 x 32.0 | 27.5 | 0.8 | MKT1820547255 |
| | 6.8 | 568 | | | 13.0 x 23.0 x 32.0 | 27.5 | | MKT1820568255 |
| | 10.0 | 610 | | | 15.0 x 25.0 x 32.0 | 27.5 | | MKT1820610255 |
| | 15.0 | 615 | | | 18.0 x 28.0 x 32.0 | 27.5 | | MKT1820615255 |
| | 18.0 | 618 | | | 21.0 x 31.0 x 32.0 | 27.5 | | MKT1820618255M |
| | 18.0 | 618 | | | 18.5 x 35.5 x 43.0 | 37.5 | 1.0 | MKT1820618255 |
| | 22.0 | 622 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820622255 |
| | 27.0 | 627 | | | 18.5 x 35.5 x 43.0 | 37.5 | | MKT1820627255 |
| | 33.0 | 633 | | | 21.5 x 38.5 x 42.0 | 37.5 | | MKT1820633255 |
| | 39.0 | 639 | | | 21.5 x 38.5 x 42.0 | 37.5 | | MKT1820639255 |
| | 47.0 | 647 | | | 24.0 x 44.0 x 42.0 | 37.5 | | MKT1820647255 |
| | 56.0 | 656 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820656255M |
| | 68.0 | 668 | | | 30.0 x 45.0 x 42.0 | 37.5 | | MKT1820668255M |
| | 56.0 | 656 | | | 25.0 x 45.0 x 57.5 | 52.5 | 1.2 | MKT1820656255 |
| | 68.0 | 668 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820668255 |
| | 82.0 | 682 | | | 25.0 x 45.0 x 57.5 | 52.5 | | MKT1820682255 |
| | 100.0 | 710 | | | 30.0 x 45.0 x 57.5 | 52.5 | | MKT1820710255 |
| | 120.0 | 712 | | | 35.0 x 50.0 x 57.5 | 52.5 | | MKT1820712255 |
| 400 | 0.010 | 310 | 40 | 200 | 3.5 x 8.0 x 13.0 | 10.0 | 0.8 | MKT1820310405 |
| | 0.015 | 315 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820315405 |
| | 0.022 | 322 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820322405 |
| | 0.033 | 333 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820333405 |
| | 0.047 | 347 | | | 4.5 x 9.5 x 13.0 | 10.0 | | MKT1820347405 |
| | 0.068 | 368 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820368405 |
| | 0.10 | 410 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820410405 |
| | 0.15 | 415 | | | 9.0 x 15.5 x13.0 | 10.0 | | MKT1820415405M |
| | 0.15 | 415 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820415405 |
| | 0.22 | 422 | | | 9.0 x 15.5 x 13.0 | 10.0 | | MKT1820422405M |
| | 0.22 | 422 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820422405 |
| | 0.33 | 433 | | | 7.5 x 13.5 x 18.0 | 15.0 | | MKT1820433405 |
| | 0.47 | 447 | | | 8.5 x 17.5 x 18.0 | 15.0 | | MKT1820447405 |
| | 0.68 | 468 | | | 8.5 x 16.5 x 26.5 | 22.5 | | MKT1820468405 |
| | 1.0 | 510 | | | 10.5 x 18.5 x 26.5 | 22.5 | | MKT1820510405 |
| | 1.5 | 515 | | | 11.0 x 21.0 x 26.5 | 22,5 | | MKT1820515405M |
| | 1.5 | 515 | | | 11.0 x 21.0 x 31.0 | 27.5 | | MKT1820515405 |
| | 2.2 | 522 | | | 13.5 x 23.5 x 31.5 | 27.5 | | MKT1820522405 |
| | 3.3 | 533 | | | 15 x 24.5 x 31.5 | 27.5 | | MKT1820533405 |
| | 4.7 | 547 | | | 18.0 x 28.0 x 31.5 | 27.5 | | MKT1820547405 |

**Notes**

(1) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

(2) Please replace “5” by: “4” for 5 % tolerance or “6” for 20 % tolerance

## ELECTRICAL DATA

| $U_{RDC}$ (V) | CAP. (µF) | CAPACITANCE CODE | VOLTAGE CODE | $V_{AC}$ | DIMENSIONS w x h x l (mm) (1) | PCM (mm) | $d_t$ ± 0.08 mm (mm) | ORDERING CODE FOR 10 % TOL./BULK PACKING (2) |
|---|---|---|---|---|---|---|---|---|
| 630 | 0.0010 | 210 | 63 | 220 | 3.5 x 8.0 x 13.0 | 10.0 | 0.80 | MKT1820210635 |
| | 0.0015 | 215 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820215635 |
| | 0.0022 | 222 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820222635 |
| | 0.0033 | 233 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820233635 |
| | 0.0047 | 247 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820247635 |
| | 0.0068 | 268 | | | 3.5 x 8.0 x 13.0 | 10.0 | | MKT1820268635 |
| | 0.010 | 310 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820310635 |
| | 0.015 | 315 | | | 4.5 x 9.5 x 13.0 | 10.0 | | MKT1820315635 |
| | 0.022 | 322 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820322635 |
| | 0.033 | 333 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820333635M |
| | 0.033 | 333 | | | 5.5 x 10.5 x 18.0 | 15.0 | | MKT1820333635 |
| | 0.047 | 347 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820347635M |
| | 0.047 | 347 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820347635 |
| | 0.068 | 368 | | | 7.5 x 13.5 x 18.0 | 15.0 | | MKT1820368635 |
| | 0.10 | 410 | | | 7.5 x 13.5 x 18.0 | 15.0 | | MKT1820410635M |
| | 0.10 | 410 | | | 6.5 x 14.5 x 26.5 | 22.5 | | MKT1820410635 |
| | 0.15 | 415 | | | 7.5 x 15.5 x 26.5 | 22.5 | | MKT1820415635 |
| | 0.22 | 422 | | | 8.5 x 16.5 x 26.5 | 22.5 | | MKT1820422635 |
| | 0.33 | 433 | | | 11.0 x 21.0 x 31.0 | 27.5 | | MKT1820433635 |
| | 0.47 | 447 | | | 11.0 x 21.0 x 31.0 | 27.5 | | MKT1820447635 |
| | 0.68 | 468 | | | 13.5 x 23.5 x 31.5 | 27.5 | | MKT1820468635 |
| | 1.0 | 510 | | | 15.0 x 24.5 x 31.5 | 27.5 | | MKT1820510635 |
| | 1.5 | 515 | | | 18.0 x 28.0 x 31.5 | 27.5 | | MKT1820515635 |
| 1000 | 0.0010 | 210 | 10 | 220 | 4.0 x 9.0 x 13.0 | 10.0 | 0.80 | MKT1820210105 |
| | 0.0015 | 215 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820215105 |
| | 0.0022 | 222 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820222105 |
| | 0.0033 | 233 | | | 4.0 x 9.0 x 13.0 | 10.0 | | MKT1820233105 |
| | 0.0047 | 247 | | | 5.5 x 10.5 x 13.0 | 10.0 | | MKT1820247105 |
| | 0.0068 | 268 | | | 6.5 x 11.5 x 13.0 | 10.0 | | MKT1820268105 |
| | 0.010 | 310 | | | 5.5 x 10.5 x 18.0 | 15.0 | | MKT1820310105 |
| | 0.015 | 315 | | | 6.5 x 12.5 x 18.0 | 15.0 | | MKT1820315105 |
| | 0.022 | 322 | | | 7.5 x 13.5 x 18.0 | 15.0 | | MKT1820322105 |
| | 0.033 | 333 | | | 8.5 x 14.5 x 18.0 | 15.0 | | MKT1820333105M |
| | 0.033 | 333 | | | 6.5 x 14.5 x 26.5 | 22.5 | | MKT1820333105 |
| | 0.047 | 347 | | | 7.5 x 15.5 x 26.5 | 22.5 | | MKT1820347105 |
| | 0.068 | 368 | | | 8.5 x 16.5 x 26.5 | 22.5 | | MKT1820368105 |
| | 0.10 | 410 | | | 10.5 x 18.5 x 26.5 | 22.5 | | MKT1820410105 |
| | 0.15 | 415 | | | 11.0 x 21.0 x 31.0 | 27.5 | | MKT1820415105 |
| | 0.22 | 422 | | | 13.5 x 23.5 x 31.5 | 27.5 | | MKT1820422105 |
| | 0.33 | 433 | | | 16.5 x 29.5 x 31.5 | 27.5 | | MKT1820433105 |
| | 0.47 | 447 | | | 20.0 x 35.0 x 31.5 | 27.5 | | MKT1820447105 |

**Notes**

(1) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

(2) Please replace “5” by: “4” for 5 % tolerance or “6” for 20 % tolerance

## RECOMMENDED PACKAGING

| PACKAGING CODE | TYPE OF PACKAGING | HEIGHT (H) (mm) | REEL DIAMETER/ BOX SIZE (mm) | ORDERING CODE EXAMPLES | PITCH 10 | PITCH 15 | PITCH 22.5 TO 27.5 | PITCH 37.5 TO 52.5 |
|---|---|---|---|---|---|---|---|---|
| G | Ammo | 18.5 | 55 x 210 x 340 | MKT1820410405G | x | x | - | - |
| W | Reel | 18.5 | 350 | MKT1820410405W | x | x | - | - |
| V | Reel | 18.5 | 500 | MKT1820422635V | - | x | x | - |
| G | Ammo | 18.5 | 60 x 360 x 510 | MKT1820422635G | - | - | x | - |
| - | Bulk | - | - | MKT1820515405 | x | x | x | x |

| EXAMPLE OF ORDERING CODE | | | | |
|---|---|---|---|---|
| TYPE | CAPACITANCE CODE | VOLTAGE CODE | TOLERANCE CODE (1) | PACKAGING CODE |
| MKT1820 | 410 | 06 | 5 | G |

## MOUNTING

### Normal Use

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoleers are designed for mounting on printed-circuit boards by means of automatic insertion machines.

For detailed tape specifications refer to packaging information www.vishay.com/docs?28139

### Specific Method of Mounting to Withstand Vibration and Shock

In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board.

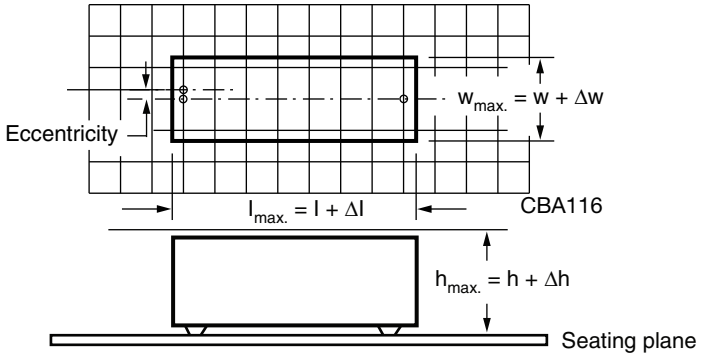
- For pitches ≤ 15 mm the capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

## SPACE REQUIREMENTS FOR PRINTED-CIRCUIT BOARD APPLICATIONS AND DIMENSION TOLERANCES

For the maximum product dimensions and maximum space requirements for length ($l_{max.}$), width ($w_{max.}$), and height ($h_{max.}$) following tolerances must be taken in account in the envelopment of the components as shown in the drawings below:

- For products with pitch ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm, and $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta w = \Delta l = 0.5$ mm, and $\Delta h = 0.1$ mm
- For products with pitch = 37.5 mm, $\Delta w = \Delta l = 0.7$ mm, and $\Delta h = 0.5$ mm
- For products with pitch = 52.5 mm, $\Delta w = \Delta l = 1.0$ mm, and $\Delta h = 0.5$ mm

Eccentricity defined as in drawing. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.




For the minimum product dimensions for length ($l_{min.}$), width ($w_{min.}$), and height ($h_{min.}$) following tolerances of the components are valid:

$l_{min.} = l - \Delta l$, $w_{min.} = w - \Delta w$, and $h_{min.} = h - \Delta h$ following

- For products with pitch ≤ 10 mm, $\Delta l = 0.3$ mm, and $\Delta w = \Delta h = 0.3$ mm
- For products with pitch = 15 mm, $\Delta l = 0.5$ mm, and $\Delta w = \Delta h = 0.5$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta l = 1.0$ mm. and $\Delta w = \Delta h = 0.5$ mm
- For products with pitch = 37.5 mm, $\Delta l = 1.0$ mm, and $\Delta w = \Delta h = 1.0$ mm
- For products with pitch = 52.5 mm, $\Delta l = 1.5$ mm, and $\Delta w = \Delta h = 1.0$ mm

## SOLDERING CONDITIONS

For general soldering conditions and wave soldering profile, we refer to the application note:
"Soldering Guidelines for Film Capacitors": www.vishay.com/doc?28171

### Storage Temperature

$T_{stg}$ = -25 °C to +35 °C with RH maximum 75 % without condensation

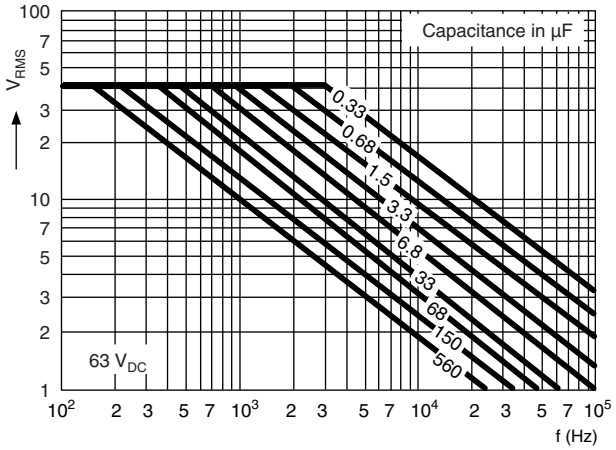
### Ratings and Characteristics Reference Conditions

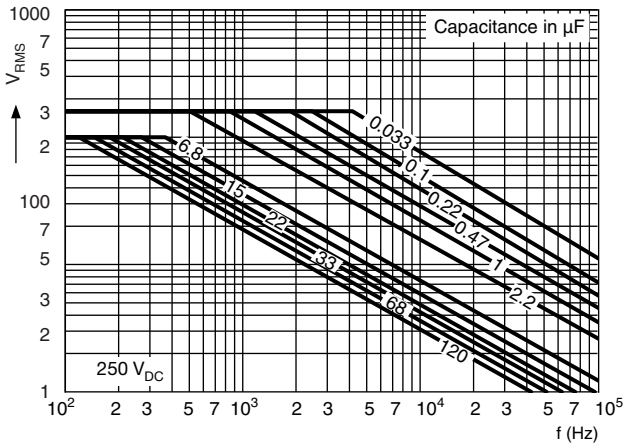
Unless otherwise specified, all electrical values apply to an ambient free temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

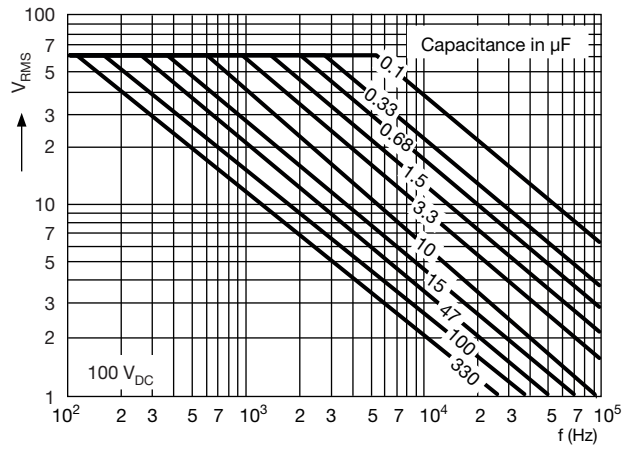
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

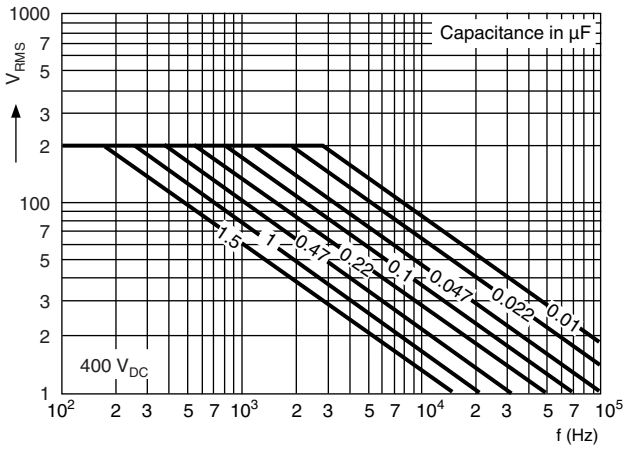
## CHARACTERISTICS

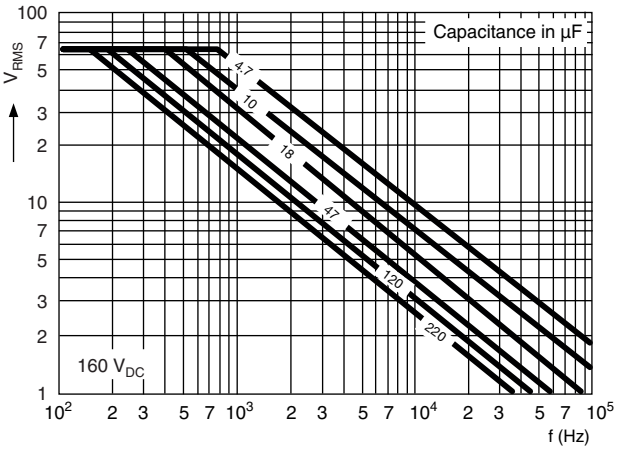
### PERMISSIBLE AC VOLTAGE VS. FREQUENCY AT $T_{amb} \leq 85$ °C

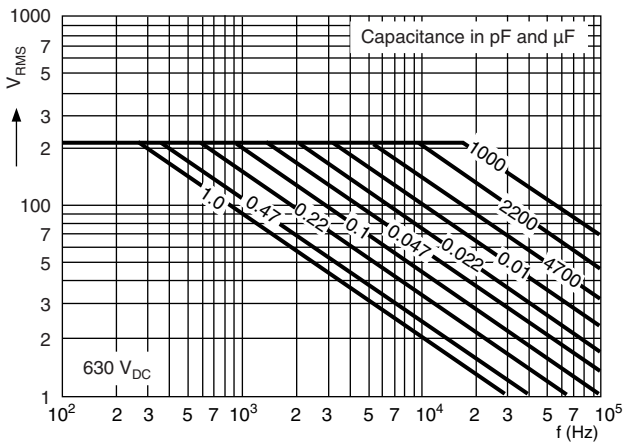


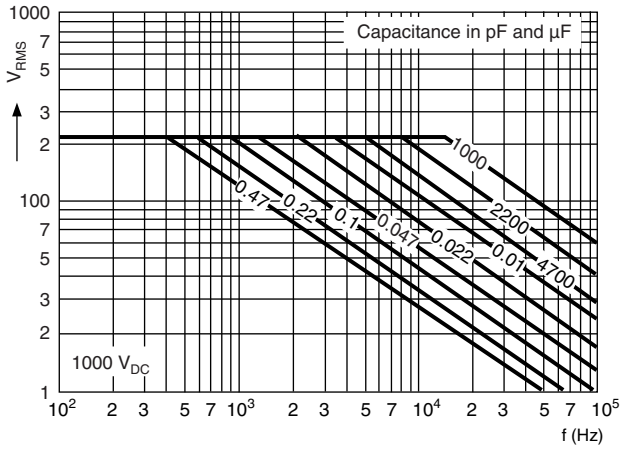



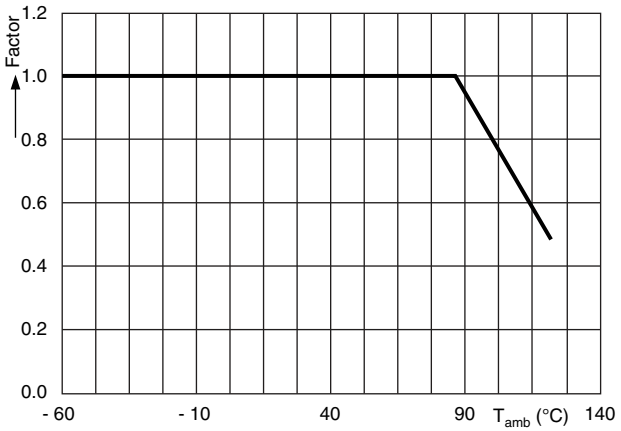



## CHARACTERISTICS

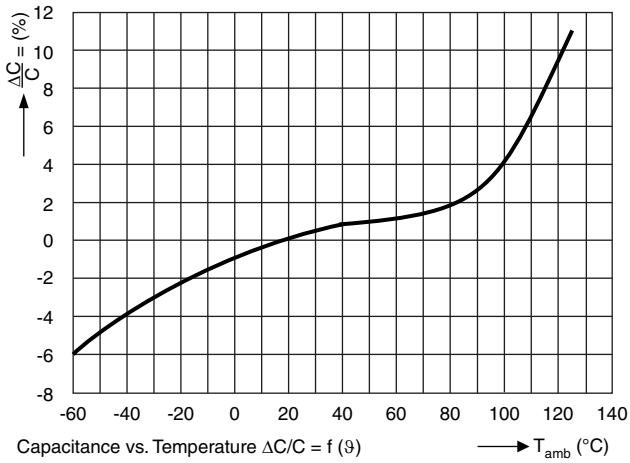
### PERMISSIBLE AC VOLTAGE VS. FREQUENCY AT $T_{amb} \leq 85$ °C



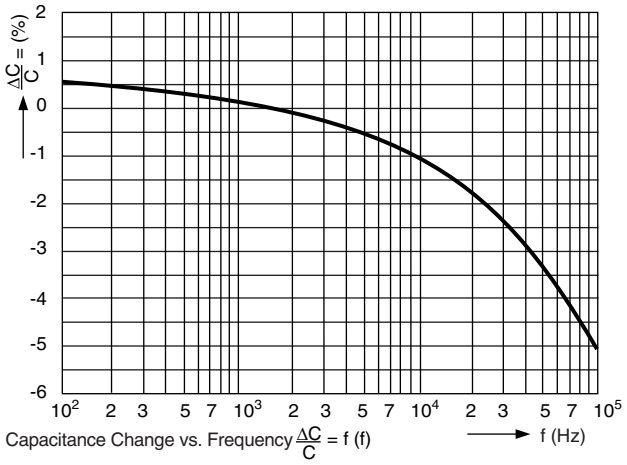

## CHARACTERISTICS



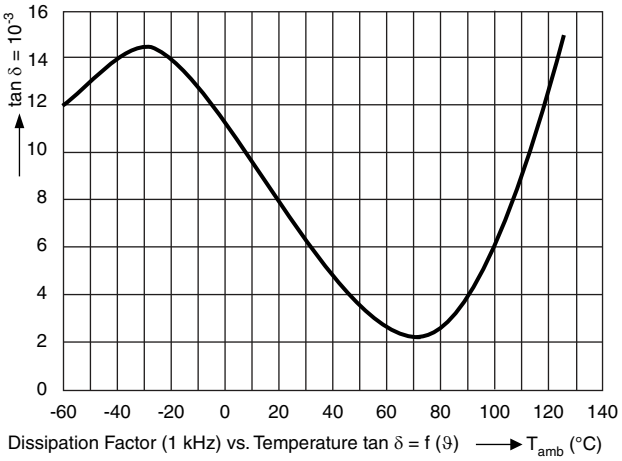

Nominal voltage (AC and DC) as a function of temperature



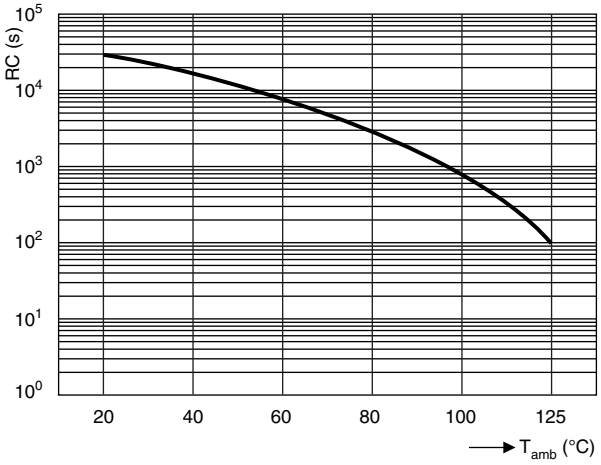

Capacitance as a function of temperature (typical curve)



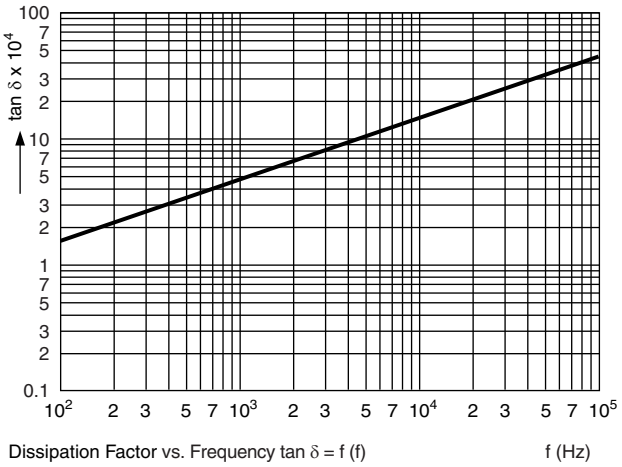

Capacitance as a function of frequency
(typical curve)



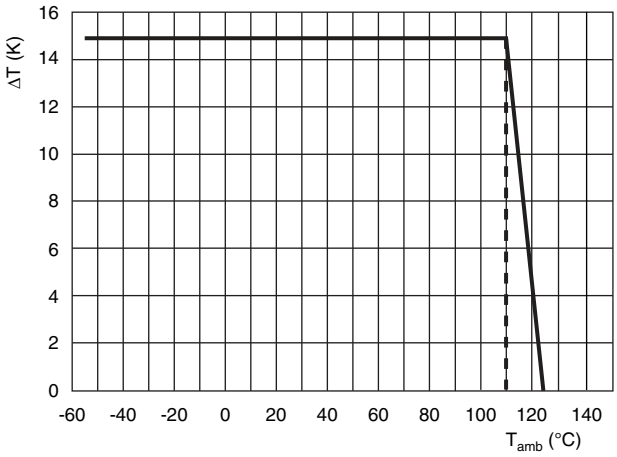

Dissipation factor as a function of temperature
(typical curve)




Insulation resistance as a function of temperature
(typical curve)




Dissipation factor as a function of frequency
(typical curve)




Maximum allowed component temperature rise (ΔT)
as function of ambient temperature ($T_{amb}$)

| HEAT CONDUCTIVITY (G) AS A FUNCTION OF CAPACITOR BODY THICKNESS IN mW/°C | | | | | | |
|---|---|---|---|---|---|---|
| $W_{max.}$ (mm) | HEAT CONDUCTIVITY (mW/°C) | | | | | |
| | PITCH 10.0 mm | PITCH 15.0 mm | PITCH 22.5 mm | PITCH 27.5 mm | PITCH 37.5 mm | PITCH 52.5 mm |
| 3.5 | 5.0 | - | - | - | - | - |
| 4.0 | 6.0 | - | - | - | - | - |
| 4.5 | 7.0 | - | - | - | - | - |
| 5.5 | 8.0 | 10.0 | - | - | - | - |
| 6.5 | 10.0 | 13.0 | 20.0 | - | - | - |
| 7.5 | - | 15.0 | 22.0 | - | - | - |
| 8.5 | - | 16.0 | 24.0 | - | - | - |
| 9.0 | - | - | - | 32.0 | - | - |
| 10.5 | - | - | 30.0 | - | - | - |
| 11.0 | - | - | - | 38.0 | - | - |
| 11.5 | - | - | - | 38.0 | - | - |
| 12.5 | - | - | 34.0 | - | - | - |
| 13.0 | - | - | - | 45.0 | - | - |
| 13.5 | - | - | - | 45.0 | - | - |
| 15.0 | - | - | - | 50.0 | - | - |
| 16.5 | - | - | - | 58.0 | - | - |
| 18.0 | - | - | - | 60.0 | - | - |
| 18.5 | - | - | - | - | 90.0 | - |
| 20.0 | - | - | - | 73.0 | - | - |
| 21.0 | - | - | - | 70.0 | - | - |
| 21.5 | - | - | - | - | 102.0 | - |
| 24.0 | - | - | - | - | 118.0 | - |
| 25.0 | - | - | - | - | - | 155.0 |
| 30.0 | - | - | - | - | 135.0 | 170.0 |
| 35.0 | - | - | - | - | - | 200.0 |

## POWER DISSIPATION AND MAXIMUM COMPONENT TEMPERATURE RISE

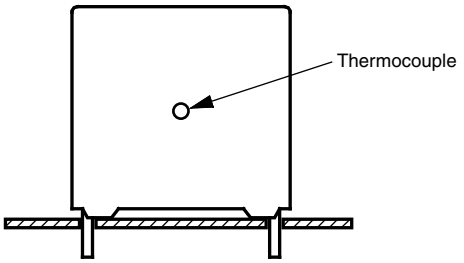
The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

The component temperature rise (ΔT) can be measured or calculated by $\Delta T = P/G$:

- ΔT = component temperature rise (°C) with a maximum of 15 °C
- P = power dissipation of the component (mW)
- G = heat conductivity of the component (mW/°C)

## MEASURING THE COMPONENT TEMPERATURE

A thermocouple must be attached to the capacitor body as in:




The temperature is measured in unloaded ($T_{amb}$) and maximum loaded condition ($T_C$).
The temperature rise is given by $\Delta T = T_C - T_{amb}$.
To avoid thermal radiation or convection, the capacitor must be tested in a closed area from air circulation.

## APPLICATION NOTE AND LIMITING CONDITIONS

These capacitors are not suitable for mains applications as across-the-line capacitors without additional protection, as described hereunder. These mains applications are strictly regulated in safety standards and therefore electromagnetic interference suppression capacitors conforming the standards must be used.

To select the capacitor for a certain application, the following conditions must be checked:

1. The peak voltage ($U_P$) shall not be greater than the rated DC voltage ($U_{RDC}$)
2. The peak-to-peak voltage ($U_{P-P}$) shall not be greater than the maximum ($U_{P-P}$) to avoid the ionization inception level
3. The voltage peak slope (dU/dt) shall not exceed the rated voltage pulse slope in an RC-circuit at rated voltage and without ringing. If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by $U_{RDC}$ and divided by the applied voltage.

   For all other pulses following equation must be fulfilled:

$$2 \times \int_0^T \left(\frac{dU}{dt}\right)^2 \times dt < U_{NDC} \times \left(\frac{dU}{dt}\right)_{rated}$$

   T is the pulse duration.
4. The maximum component surface temperature rise must be lower than the limits (see graph “Max. allowed component temperature rise”).
5. Since in circuits used at voltages over 280 V peak-to-peak the risk for an intrinsically active flammability after a capacitor breakdown (short circuit) increases, it is recommended that the power to the component is limited to 100 times the values mentioned in the table: “Heat conductivity”
6. When using these capacitors as across-the-line capacitor in the input filter for mains applications the applicant must guarantee that the following conditions are fulfilled in any case (spikes and surge voltages from the mains included).
7. For capacitors connected in parallel, normally the proof voltage and possibly the rated voltage must be reduced. For information depending of the capacitance value and the number of parallel connections contact dc-film@vishay.com.
8. For continuous use as series connection with an impedance to the mains, please refer to application note www.vishay.com/doc?28153.

| VOLTAGE CONDITIONS FOR 6 ABOVE | | | |
|---|---|---|---|
| **ALLOWED VOLTAGES** | **$T_{amb} \leq 85$ °C** | **85 °C < $T_{amb} \leq 100$ °C** | **100 °C < $T_{amb} \leq 125$ °C** |
| Maximum continuous RMS voltage | $U_{RAC}$ | 0.8 x $U_{RAC}$ | 0.5 x $U_{RAC}$ |
| Maximum temperature RMS-overvoltage (< 24 h) | 1.25 x $U_{RAC}$ | $U_{RAC}$ | 0.6 x $U_{RAC}$ |
| Maximum peak voltage ($V_{O-P}$) (< 2 s) | 1.6 x $U_{RDC}$ | 1.3 x $U_{RDC}$ | 0.5 x $U_{RDC}$ |

| AUTOMOTIVE AEC-Q200, REVISION D QUALIFICATION | | | |
|---|---|---|---|
| **STRESS** | **REFERENCE** | **CONDITION** | **PERFORMANCE REQUIREMENTS** |
| Pre- and post-stress electrical test | Spec. | - | - |
| High temperature exposure (storage) | MIL-STD 202<br>method 108 | 125 °C; unpowered<br>250 h / 500 h / 1000 h | -5 % ≤ ΔC/C ≤ +10 %<br>Increase of tan δ:<br>≤ 0.005 for C ≤ 1 µF or<br>≤ 0.003 for C > 1 µF<br>IR > 50 % of initial specified value |
| Temperature cycling | JESD22<br>method JA-104 | 1000 cycles: -55 °C / +125 °C<br>30 min dwell time at each temperature extreme<br>Transition time < 1 min | -5 % ≤ ΔC/C ≤ +10 %<br>Increase of tan δ:<br>≤ 0.005 for C ≤ 1 µF or<br>≤ 0.003 for C > 1 µF<br>IR > 50 % of initial specified value |
| Moisture resistance | MIL-STD 202<br>method 106 | 10 cycles at 24 h/cycle<br>unpowered | -5 % ≤ ΔC/C ≤ +10 %<br>Increase of tan δ:<br>≤ 0.005 for C ≤ 1 µF or<br>≤ 0.003 for C > 1 µF<br>IR > 50 % of initial specified value |
| Biased humidity | MIL-STD 202<br>method 103 | 40 °C; 93 % RH; $U_{RDC}$<br>250 h / 500 h / 1000 h | -5 % ≤ ΔC/C ≤ +10 %<br>Increase of tan δ:<br>≤ 0.005 for C ≤ 1 µF or<br>≤ 0.003 for C > 1 µF<br>IR > 50 % of initial specified value |
| Operational life | MIL-STD 202<br>method 108 | $T_A$ = 125 °C; $U_{RDC}$<br>250 h / 500 h / 1000 h | -5 % ≤ ΔC/C ≤ +10 %<br>Increase of tan δ:<br>≤ 0.003 for C ≤ 1 µF or<br>≤ 0.002 for C > 1 µF<br>IR > 50 % of initial specified value |
| External visual | MIL-STD 883<br>method 2009 | Device construction, marking and workmanship | Device construction and workmanship;<br>Legible marking |
| Dimensions | JESD22<br>method JB-100 | Spec. | Datasheet |
| Terminal strength (leaded) | MIL-STD 202<br>method 211 | Test leaded device lead integrity only.<br>- A (pull-test): 2.27 kg (10 s)<br>- C (wire-lead bend test): 227 g (3 x 3 s) | No visual damage |
| Resistance to solvents | MIL-STD 202<br>method 215 | - Also aqueous chemical<br>- OKEM clean or equivalent.<br>Do not use banned solvents | No visual damage<br>Legible marking |
| Mechanical shock | MIL-STD 202<br>method 213 | 100 *g*'s; 6 ms<br>half-sine; 3.75 m/s | No visual damage |
| Vibration | MIL-STD 202<br>method 204 | 5 *g*'s for 20 min<br>12 cycles x 3 directions<br>10 Hz to 2000 Hz | No visual damage |
| Resistance to soldering heat | MIL-STD 202<br>method 210 | Temp.: 280 °C; time: 10 s<br>solder within 1.5 mm of device body | \|ΔC/C\| ≤ 2 %<br>Increase of tan δ:<br>≤ 0.005 for C ≤ 1 µF or<br>≤ 0.003 for C > 1 µF<br>IR > 50 % of initial specified value |
| Solderability | - | - | - |
| Electrical characterization | J-STD-002 | Leaded: method A at 235 °C,<br>category 3 (245 °C / 3 s) | Good tinning as evidence by free flowing of the solder with wetting of terminations > 95 % |
| Flammability | - | - | - |

## INSPECTION REQUIREMENTS

### General Notes

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-2 and Specific Reference Data”.

| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1** | | |
| 4.1 Dimensions (detail) | | As specified in chapter “General Data” of this specification |
| 4.3.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>for C ≤ 1 µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for C ≥ 100 µF at 100 Hz | |
| 4.3 Robustness of terminations | Tensile and bending | No visible damage |
| 4.4 Resistance to soldering heat | Method: 1A<br>Solder bath: 280 °C ± 5 °C<br>Duration: 10 s | |
| 4.14 Component solvent resistance | Isopropylalcohol at room temperature<br>Method: 2<br>Immersion time: 5 min ± 0.5 min<br>Recovery time: min. 1 h, max. 2 h | |
| 4.4.2 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | $\lvert\Delta C/C\rvert \leq 2$ % of the value measured initially |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.003 for C ≤ 1 µF or<br>≤ 0.002 for C > 1 µF<br>≤ 0.004 for C ≥ 100 µF<br>Compared to values measured in 4.3.1 |
| **SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1** | | |
| 4.6.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>for C ≤ 1 µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for C ≥ 100 µF at 100 Hz | |
| 4.6 Rapid change of temperature | θA = -55 °C<br>θB = +125 °C<br>5 cycles<br>Duration t = 30 min<br>Visual examination | No visible damage<br>Legible marking |
| 4.7 Vibration | Mounting:<br>see section “Mounting” of this specification<br>Procedure B4<br>Frequency range: 10 Hz to 55 Hz<br>Amplitude: 0.75 mm or<br>Acceleration 98 m/s²<br>(whichever is less severe)<br>Total duration 6 h | |
| 4.7.2 Final inspection | Visual examination | No visible damage |
| 4.9 Shock | Mounting:<br>see section “Mounting” for more information<br>Pulse shape: half sine<br>Acceleration: 490 m/s²<br>Duration of pulse: 11 ms | |

| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1** | | |
| 4.9.3 Final measurements | Visual examination | No visible damage |
| | Capacitance | $\|\Delta C/C\| \leq 5$ % of the value measured in 4.6.1 |
| | Tangent of loss angle<br>for $C \leq 1$ µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for $C \geq 100$ µF at 100 Hz | Increase of tan δ:<br>≤ 0.003 for $C \leq 1$ µF or<br>≤ 0.002 for C > 1 µF<br>≤ 0.004 for $C \geq 100$ µF<br>Compared to values measured in 4.6.1 |
| | Insulation resistance | As specified in section “Insulation Resistance” of this specification |
| **SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B** | | |
| 4.10 Climatic sequence | | |
| 4.10.2 Dry heat | Temperature: +125 °C<br>Duration: 16 h | |
| 4.10.3 Damp heat cyclic Test Db, first cycle | | |
| 4.10.4 Cold | Temperature: -55 °C<br>Duration: 2 h | |
| 4.10.6 Damp heat cyclic Test Db, remaining cycles | | |
| 4.10.6.2 Final measurements | Voltage proof = $U_{RDC}$ for 1 min within 15 min after removal from testchamber | No breakdown or flashover |
| | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | $\|\Delta C/C\| \leq 5$ % of the value measured in 4.4.2 or 4.9.3 |
| | Tangent of loss angle<br>for $C \leq 1$ µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for $C \geq 100$ µF at 100 Hz | Increase of tan δ:<br>≤ 0.005 for $C \leq 1$ µF or<br>≤ 0.003 for C > 1 µF<br>≤ 0.004 for $C \geq 100$ µF<br>Compared to values measured in 4.3.1 or 4.6.1 |
| | Insulation resistance | ≥ 50 % of values specified in section “Insulation Resistance” of this specification |
| **SUB-GROUP C2** | | |
| 4.11 Damp heat steady state | 56 days; 40 °C; 90 % to 95 % RH | |
| 4.11.1 Initial measurements | Capacitance | |
| | Tangent of loss angle<br>for $C \leq 1$ µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for $C \geq 100$ µF at 100 Hz | |
| 4.11.3 Final measurements | Voltage proof = $U_{RDC}$ for 1 min within 15 min after removal from testchamber | No breakdown or flashover |
| | Visual examination | No visible damage<br>Legible marking |

| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C2** | | |
| 4.11.3 Final measurements | Capacitance | $\|\Delta C/C\| \leq 5$ % of the value measured in 4.11.1. |
| | Tangent of loss angle<br>for $C \leq 1$ µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for $C \geq 100$ µF at 100 Hz | Increase of tan δ<br>≤ 0.005 for $C \leq 1$ µF or<br>≤ 0.003 for $C > 1$ µF<br>≤ 0.004 for $C \geq 100$ µF<br>Compared to values measured in 4.11.1 |
| | Insulation resistance | ≥ 50 % of values specified in section "Insulation Resistance" of this specification |
| **SUB-GROUP C3** | | |
| 4.12 Endurance | Duration: 2000 h<br>1.25 x $U_{RDC}$ at 85 °C<br>1.0 x $U_{RDC}$ at 100 °C<br>0.6 x $U_{RDC}$ at 125 °C<br>Duration: 200 h<br>0.3 x $U_{RDC}$ at 150 °C<br>(not applicable for pitch ≥ 37.5 mm) | |
| 4.12.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>for $C \leq 1$ µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for $C \geq 100$ µF at 100 Hz | |
| 4.12.5 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | $\|\Delta C/C\| \leq 5$ % compared to values measured in 4.12.1 |
| | Tangent of loss angle<br>For $C \leq 1$ µF at 10 kHz<br>For 1 µF < C < 100 µF at 1 kHz<br>For $C \geq 100$ µF at 100 Hz | Increase of tan δ:<br>≤ 0.003 for $C \leq 1$ µF or<br>≤ 0.002 for 1 µF < C < 100 µF<br>≤ 0.004 for $C \geq 100$ µF<br>Compared to values measured in 4.12.1 |
| | Insulation resistance | ≥ 50 % of values specified in section "Insulation Resistance" of this specification |
| **SUB-GROUP C4** | | |
| 4.13 Charge and discharge | 10 000 cycles<br>Charged to $U_{RDC}$<br>Discharge resistance:<br>$R = \frac{U_R}{C \times K \times (dU/dt)_R}$<br>K = 5 for pitch ≤ 27.5 mm<br>K = 1.5 for pitch 37.5 mm/52.5 mm | |
| 4.13.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>for $C \leq 1$ µF at 10 kHz<br>for 1 µF < C < 100 µF at 1 kHz<br>for $C \geq 100$ µF at 100 Hz | |
| 4.13.3 Final measurements | Capacitance | $\|\Delta C/C\| \leq 3$ % compared to values measured in 4.13.1 |
| | Tangent of loss angle: | Increase of tan δ:<br>≤ 0.003 for $C \leq 1$ µF or<br>≤ 0.002 for $C > 1$ µF<br>≤ 0.004 for $C \geq 100$ µF<br>Compared to values measured in 4.13.1 |
| | Insulation resistance | ≥ 50 % of values specified in section "Insulation Resistance" of this specification |

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