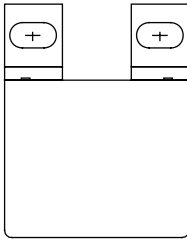
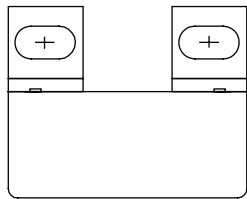
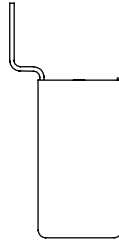


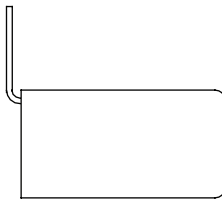
# AC and Pulse Double Metallized Polypropylene Film Capacitors MMKP Radial Potted Type



Horizontally Mounted



Vertically Mounted



## APPLICATIONS

Industrial motor control circuits, mounted directly on the IGBT or GTO.

## REFERENCE SPECIFICATIONS

IEC 60384-17

## MARKING

C-value; tolerance; rated voltage; code for dielectric material; code for factory of origin; manufacturer's type, manufacturer; year and week of manufacture

## DIELECTRIC

Polypropylene film

## ELECTRODES

Double metallized

## CONSTRUCTION

Mono construction for 630 V version  
Internal serial construction from 850 Vdc on

## RATED (DC) VOLTAGE

630 V, 850 V, 1000 V, 1250 V, 1400 V, 1600 V, 2000 V, 2500 V

## RATED (AC) VOLTAGE

220 V, 300 V, 350 V, 425 V, 500 V, 550 V, 700 V, 900 V

## RATED PEAK-TO-PEAK VOLTAGE

630 V, 850 V, 1000 V, 1250 V, 1400 V, 1600 V, 2000 V, 2500 V

## FEATURES

Low inductive construction  
Low loss dielectric  
Double sided metallized for high pulse ratings  
RoHS compliant



**RoHS**  
COMPLIANT

## ENCAPSULATION

Flame retardant plastic case (UL-class 94 V-0) and epoxy resin

## CLIMATIC TESTING CLASS ACC. TO IEC 60068-1

55/085/56

## CAPACITANCE RANGE (E24 SERIES)

0.1 to 4.7  $\mu$ F

## CAPACITANCE TOLERANCE

$\pm 5 \%$ ;  $\pm 10 \%$

## TABS

Tinned coated copper

## RATED (DC) TEMPERATURE

85 °C

## RATED (AC) TEMPERATURE

85 °C

## MAXIMUM APPLICATION TEMPERATURE

85 °C

## PERFORMANCE GRADE

Grade 1 (long life)

## STABILITY GRADE

Grade 2

## DETAIL SPECIFICATION

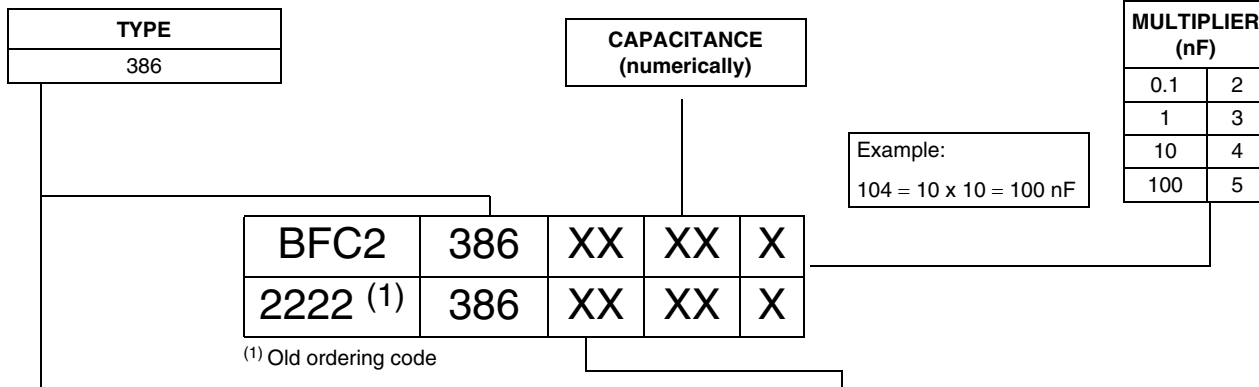
For more detailed data and test requirements contact:  
[dc-film@vishay.com](mailto:dc-film@vishay.com)

# MMKP 386



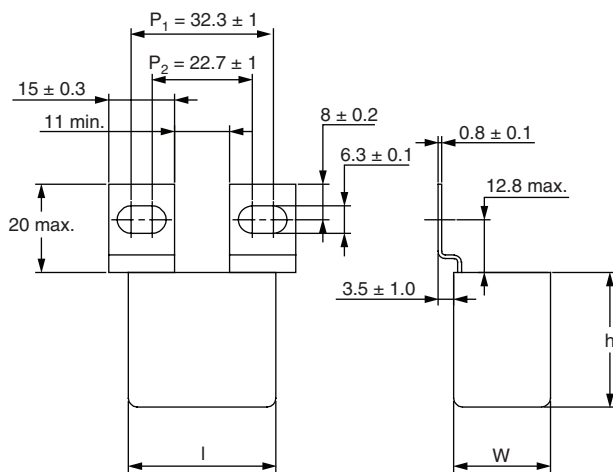
Vishay BCcomponents AC and Pulse Double Metallized Polypropylene Film Capacitors MMKP Radial Potted Type

## COMPOSITION OF CATALOG NUMBER

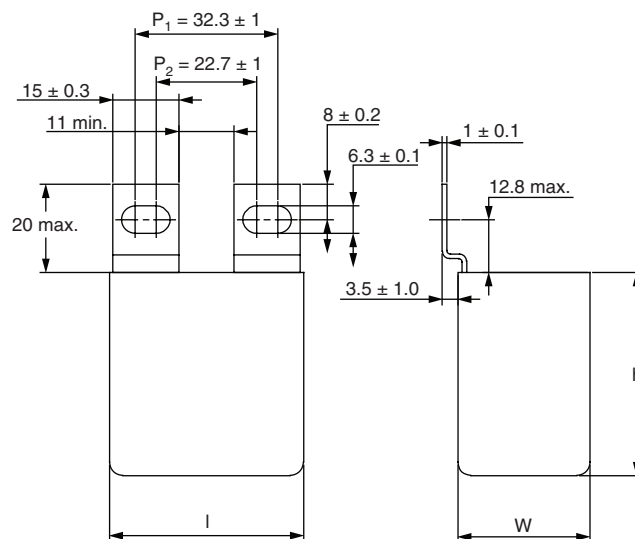


| TYPE | PACKAGING    | MOUNTING CONFIGURATION | PREFERRED TYPES |       |       |        |        |        |        |        |        |
|------|--------------|------------------------|-----------------|-------|-------|--------|--------|--------|--------|--------|--------|
|      |              |                        | C-TOL.          | 630 V | 850 V | 1000 V | 1250 V | 1400 V | 1600 V | 2000 V | 2500 V |
| 386  | Loose in box | Horizontally mounted   | ± 10 %          | 20    | 00    | 30     | 80     | 40     | 50     | 60     | 70     |
|      |              | Vertically mounted     | ± 10 %          | 22    | 02    | 32     | 82     | 42     | 52     | 62     | 72     |
|      |              |                        | ON REQUEST      |       |       |        |        |        |        |        |        |
| 386  | Loose in box | Horizontally mounted   | ± 5 %           | 21    | 01    | 31     | 81     | 41     | 51     | 61     | 71     |
|      |              | Vertically mounted     | ± 5 %           | 23    | 03    | 33     | 83     | 43     | 53     | 63     | 73     |

### Horizontally Mounted



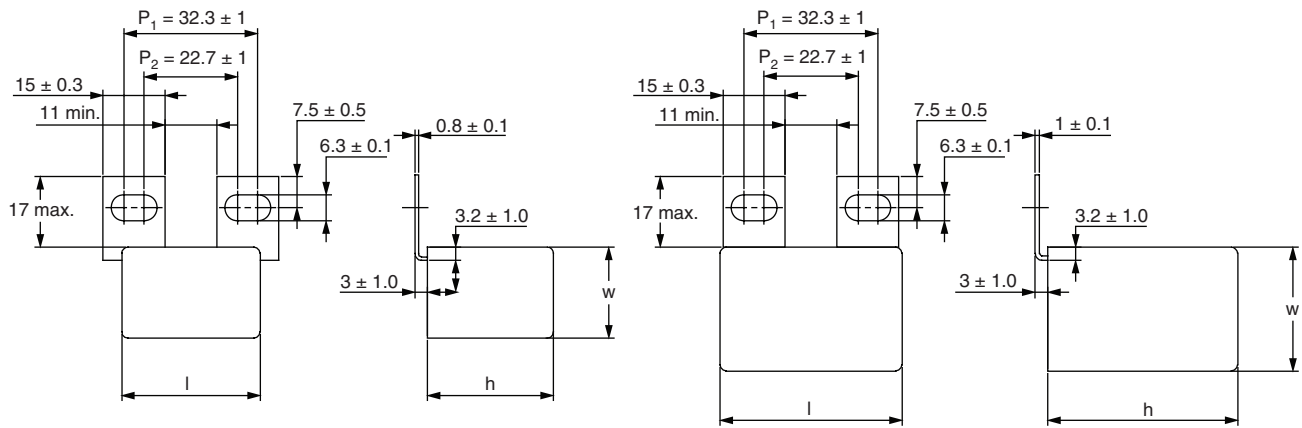
Drawing A



Drawing B

P<sub>1</sub> = Pitch 1  
P<sub>2</sub> = Pitch 2

# AC and Pulse Double Metallized Polypropylene Film Capacitors MMKP Radial Potted Type

**Vertically Mounted**


Drawing A

Drawing B

$P_1$  = Pitch 1  
 $P_2$  = Pitch 2

**SPECIFIC REFERENCE DATA**

| DESCRIPTION  | VALUE                                  |                                |                                      |                                 |                                |                                |                                |                                |
|--|--|--------------------------------|--------------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|  | 630 V                                  | 850 V                          | 1000 V                               | 1250 V                          | 1400 V                         | 1600 V                         | 2000 V                         | 2500 V                         |
| Capacitance range  | 0.33 $\mu$ F<br>to 4.7 $\mu$ F         | 0.22 $\mu$ F<br>to 2.7 $\mu$ F | 0.33 $\mu$ F<br>to 1.8 $\mu$ F       | 0.15 $\mu$ F<br>to 0.82 $\mu$ F | 0.1 $\mu$ F<br>to 0.68 $\mu$ F | 0.1 $\mu$ F<br>to 0.56 $\mu$ F | 0.1 $\mu$ F<br>to 0.47 $\mu$ F | 0.1 $\mu$ F<br>to 0.27 $\mu$ F |
| Maximum operating DC voltage   | 630 V                                  | 850 V                          | 1000 V                               | 1250 V                          | 1400 V                         | 1600 V                         | 2000 V                         | 2500 V                         |
| Maximum operating AC voltage   | 220 V                                  | 300 V                          | 350 V                                | 425 V                           | 500 V                          | 550 V                          | 700 V                          | 900 V                          |
| Tangent of loss angle  | $\leq 0.47 \mu$ F                      |                                | $0.56 \mu$ F $\leq C \leq 1.0 \mu$ F |                                 |                                | $C > 1.0$ F                    |                                |                                |
| at 1 kHz   | $< 5 \times 10^{-4}$                   |                                | $< 5 \times 10^{-4}$                 |                                 |                                | $< 10 \times 10^{-4}$          |                                |                                |
| at 10 kHz  | $< 10 \times 10^{-4}$                  |                                | $< 10 \times 10^{-4}$                |                                 |                                | $< 20 \times 10^{-4}$          |                                |                                |
| at 100 kHz   | $< 12 \times 10^{-4}$                  |                                | $< 25 \times 10^{-4}$                |                                 |                                |                                |                                |                                |
| R between terminals at 500 V;<br>1 min                                     | $> 5000$ M $\Omega$                    |                                |                                      |                                 |                                |                                |                                |                                |
| R between terminals and case;<br>500 V; 1 min                              | $> 30\,000$ M $\Omega$                 |                                |                                      |                                 |                                |                                |                                |                                |
| Withstanding (DC) voltage<br>(cut off current 10 mA);<br>rise time 100 V/s | 1000 V;<br>1 min                       | 1360 V;<br>1 min               | 1600 V;<br>1 min                     | 2000 V;<br>1 min                | 2240 V;<br>1 min               | 2560 V;<br>1 min               | 3200 V;<br>1 min               | 4000 V;<br>1 min               |
| Withstanding (DC) voltage<br>between terminals and case                    | 2840 V; 1 min                          |                                |                                      |                                 |                                |                                |                                |                                |
| Maximum dU/dt (V/ $\mu$ s)   | 630 V                                  | 850 V                          | 1000 V                               | 1250 V                          | 1400 V                         | 1600 V                         | 2000 V                         | 2500 V                         |
| w x h x l = 22.0 x 30.5 x 33.5   | 250                                    | 650                            | 1000                                 | 1500                            | 2000                           | 2400                           | 2500                           | 5500                           |
| w x h x l = 22.0 x 38.0 x 44.0   | 100                                    | 350                            | 500                                  | 750                             | 900                            | 1000                           | 1000                           | 2000                           |
| w x h x l = 30.0 x 46.0 x 44.0   | 75                                     | 260                            | 350                                  | 550                             | 650                            | 750                            | 750                            | 1500                           |
| ESR at 100 kHz   | 6 m $\Omega$                           |                                |                                      |                                 |                                |                                |                                |                                |
| ESL  | Typical 15 nH                          |                                |                                      |                                 |                                |                                |                                |                                |
| Temperature range  | - 55 $^{\circ}$ C to + 85 $^{\circ}$ C |                                |                                      |                                 |                                |                                |                                |                                |

# MMKP 386



## Vishay BCcomponents AC and Pulse Double Metallized Polypropylene Film Capacitors MMKP Radial Potted Type

$U_{Rdc} = 630\text{ V}$ ;  $U_{Rac} = 220\text{ V}/U_{pp} = 630\text{ V}$

| C<br>( $\mu\text{F}$ ) | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |     |
|------------------------|---------------------------------|-------------|---|-----|
|                        |                                 |             | TRAY PACKAGING                              |     |
|                        |                                 |             | C-tol. = $\pm 10\%$                         | SPQ |
| <b>Drawing A</b>       |                                 |             |   |     |
| 0.33                   | 22.0 x 30.5 x 33.5              | 39          | 20334                                       | 56  |
| 0.39                   |                                 | 38          | 20394                                       |     |
| 0.47                   |                                 | 38          | 20474                                       |     |
| 0.56                   |                                 | 37          | 20564                                       |     |
| 0.68                   |                                 | 37          | 20684                                       |     |
| 0.82                   |                                 | 36          | 20824                                       |     |
| 1                      |                                 | 35          | 20105                                       |     |
| 1.2                    |                                 | 35          | 20125                                       |     |
| <b>Drawing B</b>       |                                 |             |   |     |
| 1.5                    | 22.0 x 38.0 x 44.0              | 60          | 20155                                       | 42  |
| 1.8                    |                                 | 58          | 20185                                       |     |
| 2.2                    |                                 | 56          | 20225                                       |     |
| 2.7                    |                                 | 54          | 20275                                       |     |
| 3.3                    | 30.0 x 46.0 x 44.0              | 86          | 20335                                       | 36  |
| 3.9                    |                                 | 83          | 20395                                       |     |
| 4.7                    |                                 | 80          | 20475                                       |     |

• SPQ = Standard Packing Quantity

$U_{Rdc} = 850\text{ V}$ ;  $U_{Rac} = 300\text{ V}/U_{pp} = 850\text{ V}$

| C<br>( $\mu\text{F}$ ) | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |     |
|------------------------|---------------------------------|-------------|---|-----|
|                        |                                 |             | TRAY PACKAGING                              |     |
|                        |                                 |             | C-tol. = $\pm 10\%$                         | SPQ |
| <b>Drawing A</b>       |                                 |             |   |     |
| 0.22                   | 22.0 x 30.5 x 33.5              | 39          | 00224                                       | 56  |
| 0.27                   |                                 | 39          | 00274                                       |     |
| 0.33                   |                                 | 38          | 00334                                       |     |
| 0.39                   |                                 | 38          | 00394                                       |     |
| 0.47                   |                                 | 37          | 00474                                       |     |
| 0.56                   |                                 | 37          | 00564                                       |     |
| 0.68                   |                                 | 36          | 00684                                       |     |
| 0.82                   |                                 | 35          | 00824                                       |     |
| <b>Drawing B</b>       |                                 |             |   |     |
| 1.0                    | 22.0 x 38.0 x 44.0              | 61          | 00105                                       | 42  |
| 1.2                    |                                 | 59          | 00125                                       |     |
| 1.5                    |                                 | 58          | 00155                                       |     |
| 1.8                    | 30.0 x 46.0 x 44.0              | 91          | 00185                                       | 36  |
| 2.2                    |                                 | 88          | 00225                                       |     |
| 2.7                    |                                 | 85          | 00275                                       |     |

• SPQ = Standard Packing Quantity

$U_{Rdc} = 1000\text{ V}$ ;  $U_{Rac} = 350\text{ V}/U_{pp} = 1000\text{ V}$

| C<br>( $\mu\text{F}$ ) | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |     |
|------------------------|---------------------------------|-------------|---|-----|
|                        |                                 |             | TRAY PACKAGING                              |     |
|                        |                                 |             | C-tol. = $\pm 10\%$                         | SPQ |
| <b>Drawing A</b>       |                                 |             |   |     |
| 0.33                   | 22.0 x 30.5 x 33.5              | 36          | 30334                                       | 56  |
| 0.39                   |                                 | 35          | 30394                                       |     |
| 0.47                   |                                 | 34          | 30474                                       |     |
| <b>Drawing B</b>       |                                 |             |   |     |
| 0.56                   | 22.0 x 38.0 x 44.0              | 60          | 30564                                       | 42  |
| 0.68                   |                                 | 59          | 30684                                       |     |
| 0.82                   |                                 | 57          | 30824                                       |     |
| 1.0                    |                                 | 55          | 30105                                       |     |
| 1.2                    | 30.0 x 46.0 x 44.0              | 88          | 30125                                       | 36  |
| 1.5                    |                                 | 84          | 30155                                       |     |
| 1.8                    |                                 | 80          | 30185                                       |     |

• SPQ = Standard Packing Quantity



**AC and Pulse Double Metallized Polypropylene Vishay BCcomponents  
Film Capacitors MMKP Radial Potted Type**

**U<sub>Rdc</sub> = 1250 V; U<sub>Rac</sub> = 425 V/U<sub>pp</sub> = 1250 V**

| C<br>( $\mu$ F)              | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g)          | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |                         |                         |
|------------------------------|---------------------------------|----------------------|---|-------------------------|-------------------------|
|                              |                                 |                      | TRAY PACKAGING                              |                         |                         |
|                              |                                 |                      | C-tol. = $\pm$ 10 %                         | SPQ                     |                         |
| <b>Drawing A</b>             |                                 |                      |   |                         |                         |
| 0.15<br>0.18<br>0.22<br>0.27 | 22.0 x 30.5 x 33.5              | 37<br>35<br>34<br>33 | 80154<br>80184<br>80224<br>80274            | 56                      |                         |
| <b>Drawing B</b>             |                                 |                      |   |                         |                         |
| 0.33<br>0.39<br>0.47         |                                 | 22.0 x 38.0 x 44.0   | 59<br>58<br>57                              | 80334<br>80394<br>80474 | 42                      |
| 0.56<br>0.68<br>0.82         |                                 |                      | 30.0 x 46.0 x 44.0                          | 89<br>85<br>82          | 80564<br>80684<br>80824 |

• SPQ = Standard Packing Quantity

**U<sub>Rdc</sub> = 1400 V; U<sub>Rac</sub> = 500 V/U<sub>pp</sub> = 1400 V**

| C<br>( $\mu$ F)              | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g)        | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |                                  |    |
|------------------------------|---------------------------------|--------------------|---|----------------------------------|----|
|                              |                                 |                    | TRAY PACKAGING                              |                                  |    |
|                              |                                 |                    | C-tol. = $\pm$ 10 %                         | SPQ                              |    |
| <b>Drawing A</b>             |                                 |                    |   |                                  |    |
| 0.1<br>0.12<br>0.15          | 22.0 x 30.5 x 33.5              | 37<br>36<br>35     | 40104<br>40124<br>40154                     | 56                               |    |
| <b>Drawing B</b>             |                                 |                    |   |                                  |    |
| 0.18<br>0.22<br>0.27<br>0.33 |                                 | 22.0 x 38.0 x 44.0 | 61<br>59<br>57<br>56                        | 40184<br>40224<br>40274<br>40334 | 42 |
| 0.39<br>0.47<br>0.56<br>0.68 | 30.0 x 46.0 x 44.0              |                    | 89<br>85<br>82<br>79                        | 40394<br>40474<br>40564<br>40684 | 36 |

• SPQ = Standard Packing Quantity

**U<sub>Rdc</sub> = 1600 V; U<sub>Rac</sub> = 550 V/U<sub>pp</sub> = 1600 V**

| C<br>( $\mu$ F)              | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g)        | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |                                  |    |
|------------------------------|---------------------------------|--------------------|---|----------------------------------|----|
|                              |                                 |                    | TRAY PACKAGING                              |                                  |    |
|                              |                                 |                    | C-tol. = $\pm$ 10 %                         | SPQ                              |    |
| <b>Drawing A</b>             |                                 |                    |   |                                  |    |
| 0.1<br>0.12<br>0.15          | 22.0 x 30.5 x 33.5              | 37<br>36<br>35     | 50104<br>50124<br>40154                     | 56                               |    |
| <b>Drawing B</b>             |                                 |                    |   |                                  |    |
| 0.18<br>0.22<br>0.27<br>0.33 |                                 | 22.0 x 38.0 x 44.0 | 61<br>59<br>58<br>57                        | 50184<br>50224<br>50274<br>50334 | 42 |
| 0.39<br>0.47<br>0.56         | 30.0 x 46.0 x 44.0              |                    | 90<br>87<br>84                              | 50394<br>50474<br>50564          | 36 |

• SPQ = Standard Packing Quantity

# MMKP 386



## Vishay BCcomponents AC and Pulse Double Metallized Polypropylene Film Capacitors MMKP Radial Potted Type

$U_{Rdc} = 2000\text{ V}$ ;  $U_{Rac} = 700\text{ V}$ / $U_{pp} = 2000\text{ V}$

| C<br>( $\mu\text{F}$ )       | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |     |
|------------------------------|---------------------------------|-------------|---|-----|
|                              |                                 |             | TRAY PACKAGING                              |     |
|                              |                                 |             | C-tol. = $\pm 10\%$                         | SPQ |
| <b>Drawing A</b>             |                                 |             |   |     |
| 0.1<br>0.12                  | 22.0 x 30.5 x 33.5              | 36          | 60104                                       | 56  |
|                              |                                 | 35          | 60124                                       |     |
| <b>Drawing B</b>             |                                 |             |   |     |
| 0.15<br>0.18<br>0.22<br>0.27 | 22.0 x 38.0 x 44.0              | 61          | 60154                                       | 42  |
|                              |                                 | 59          | 60184                                       |     |
|                              |                                 | 58          | 60224                                       |     |
|                              |                                 | 57          | 60274                                       |     |
| 0.33<br>0.39<br>0.47         | 30.0 x 46.0 x 44.0              | 89          | 60334                                       | 36  |
|                              |                                 | 86          | 60394                                       |     |
|                              |                                 | 84          | 60474                                       |     |

• SPQ = Standard Packing Quantity

$U_{Rdc} = 2500\text{ V}$ ;  $U_{Rac} = 700\text{ V}$ / $U_{pp} = 2500\text{ V}$

| C<br>( $\mu\text{F}$ )      | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) | CATALOG NUMBER BFC2 386 XXXXX AND PACKAGING |     |
|-----------------------------|---------------------------------|-------------|---|-----|
|                             |                                 |             | TRAY PACKAGING                              |     |
|                             |                                 |             | C-tol. = $\pm 10\%$                         | SPQ |
| <b>Drawing B</b>            |                                 |             |   |     |
| 0.1<br>0.12<br>0.15<br>0.18 | 22.0 x 38.0 x 44.0              | 60          | 70104                                       | 42  |
|                             |                                 | 59          | 70124                                       |     |
|                             |                                 | 57          | 70154                                       |     |
|                             |                                 | 55          | 70184                                       |     |
| 0.22<br>0.27                | 30.0 x 46.0 x 44.0              | 87          | 70224                                       | 36  |
|                             |                                 | 83          | 70274                                       |     |

• SPQ = Standard Packing Quantity

## MOUNTING

### Normal Use

The capacitors are designed for direct mounting on IGBT or GTO.

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

In order to withstand vibration and shock tests, it must be ensured that the tabs are screwed tightly on the test board.

### Storage Temperature

Storage temperature:  $T_{stg} = -25\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$  with RH maximum 80 % without condensation.

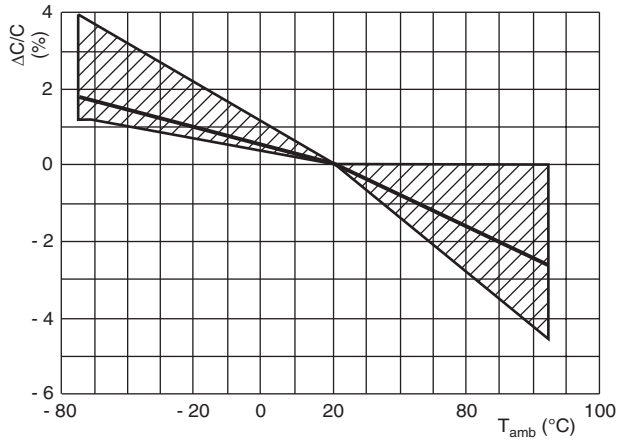
### Ratings and Characteristics Reference Conditions

Unless otherwise specified, all electrical values apply to an ambient temperature of  $23\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ , an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of  $50\% \pm 2\%$ .

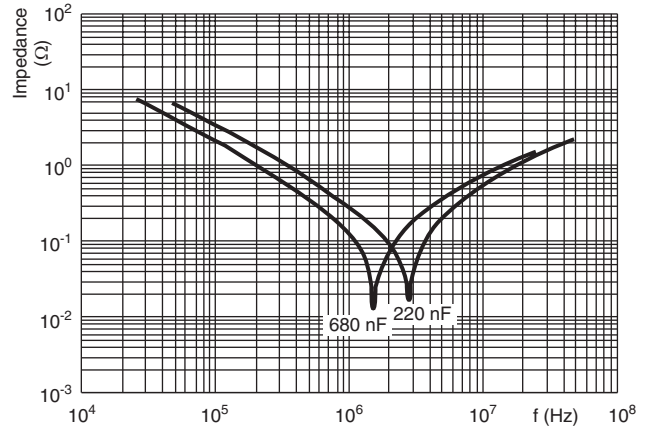
For reference testing, a conditioning period shall be applied over  $96\text{ h} \pm 4\text{ h}$  by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

**CHARACTERISTICS**

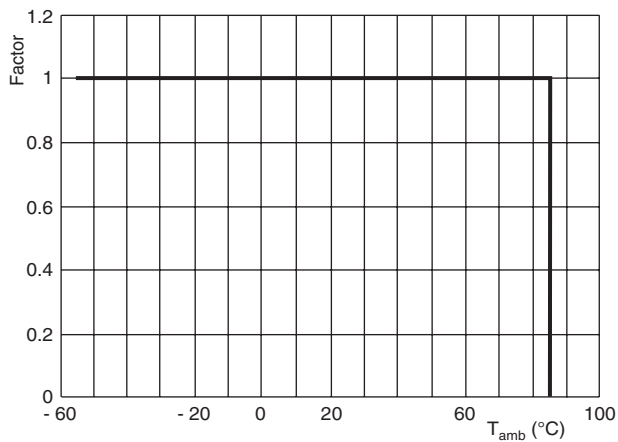
Capacitance as a function of ambient temperature (typical curve)



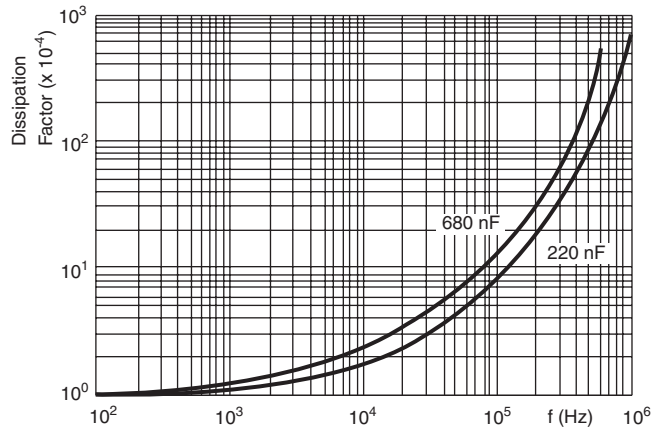
Impedance as a function of frequency (typical curve)



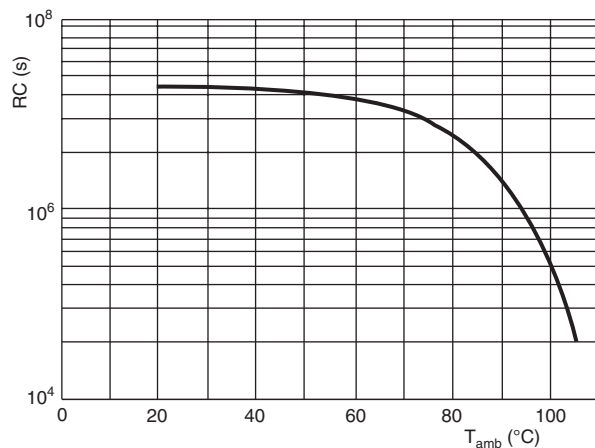
Max. DC and AC voltage as function of temperature



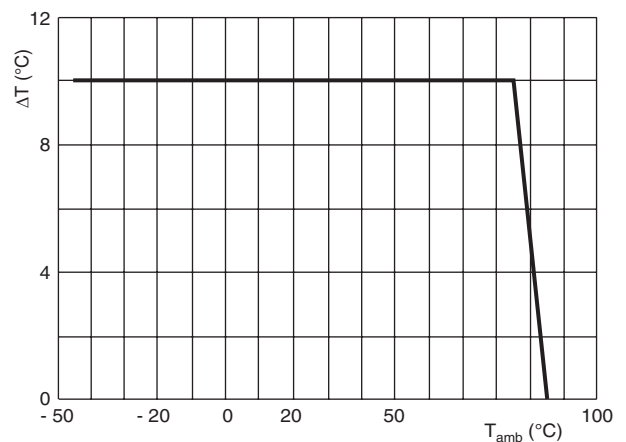
Tangent of loss angle as a function of frequency (typical curve)



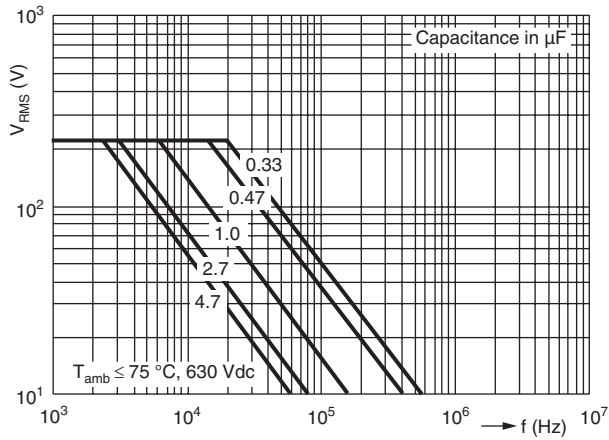
Insulation resistance as a function of ambient temperature (typical curve)



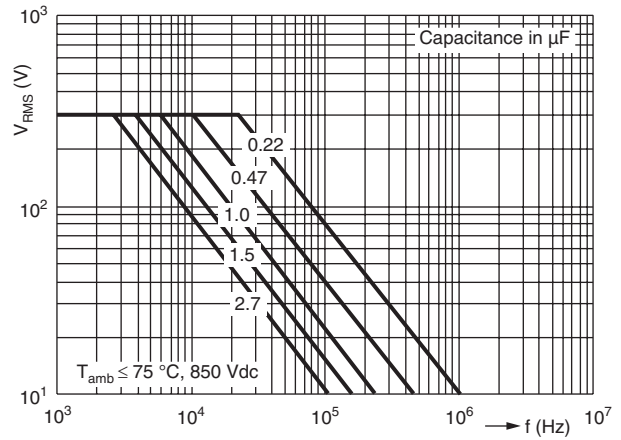
Max. allowed component temperature as a function of ambient temperature



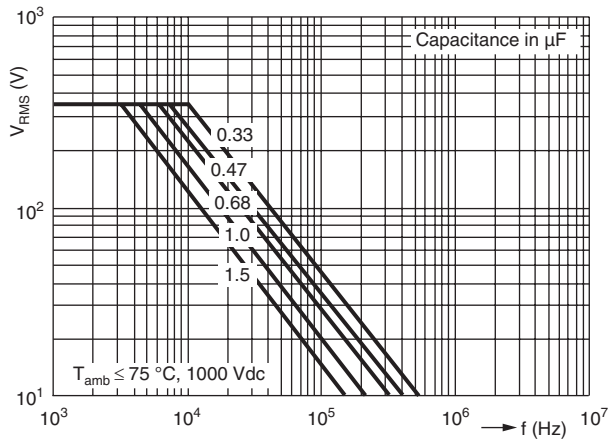
Max. AC voltage as a function of frequency



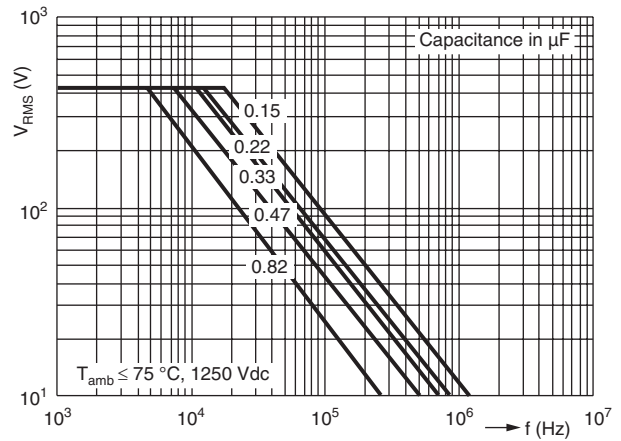
Max. AC voltage as a function of frequency



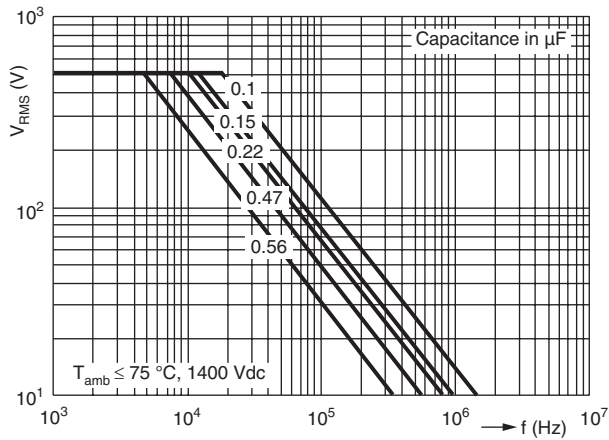
Max. AC voltage as a function of frequency



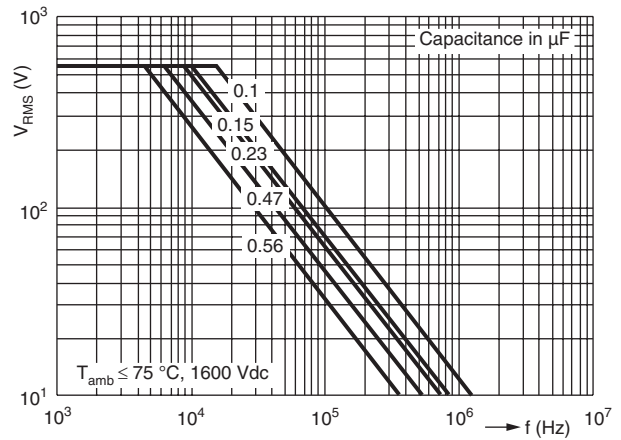
Max. AC voltage as a function of frequency



Max. AC voltage as a function of frequency



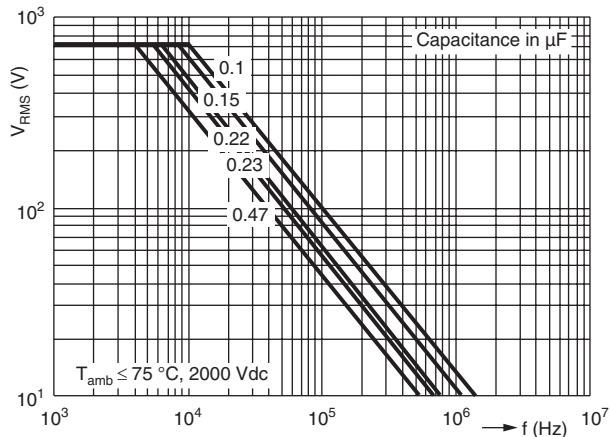
Max. AC voltage as a function of frequency



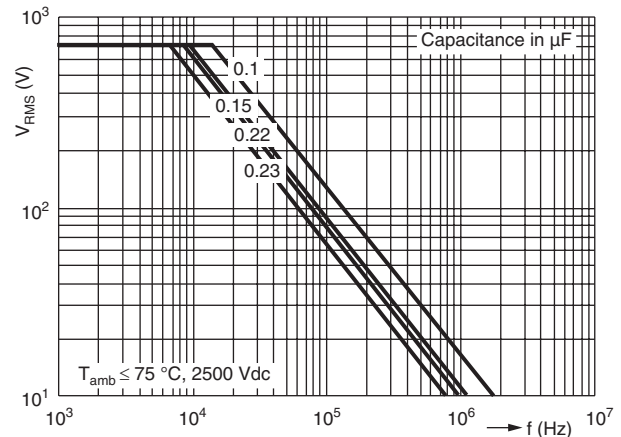


## AC and Pulse Double Metallized Polypropylene Film Capacitors MMKP Radial Potted Type

Max. AC voltage as a function of frequency



Max. AC voltage as a function of frequency



### HEAT CONDUCTIVITY (G) AS A FUNCTION OF BOX LENGTH AND CAPACITOR BODY THICKNESS IN mW/°C

| W <sub>max.</sub><br>(mm) | HEAT CONDUCTIVITY (mW/°C) |                    |
|---------------------------|---------------------------|--------------------|
|                           | BOX LENGTH 33.5 mm        | BOX LENGTH 44.0 mm |
| 22.0                      | 75                        | 100                |
| 30.0                      | -                         | 140                |

### 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.

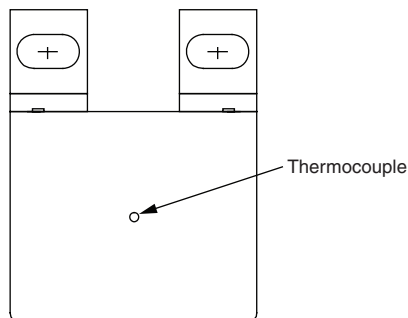
The power dissipation can be calculated according type detail specification "HQN-384-0/101: Technical Information Film Capacitors".

The component temperature rise ( $\Delta T$ ) can be measured (see section "Measuring the component temperature" for more details) or calculated by  $\Delta T = P/G$ :

- $\Delta T$  = Component temperature rise (°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 radiation or convection, the capacitor should be tested in a wind-free box.

### 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 ionisation inception level
3. The voltage pulse 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:

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

T is the pulse duration.

The rated voltage pulse slope is valid for ambient temperatures up to 85 °C.

4. The maximum component surface temperature rise must be lower than the limits (see figure).
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"

### Voltage Conditions

| ALLOWED VOLTAGES                             | $T_{amb} \leq 85 \text{ }^\circ\text{C}$ |
|--|--|
| Maximum continuous RMS voltage               | $U_{Rac}$                                |
| Maximum temperature RMS-overvoltage (< 24 h) | $1.25 \times U_{Rac}$                    |
| Maximum peak voltage ( $V_{O-P}$ ) (< 2 s)   | $1.6 \times U_{Rdc}$                     |

### INSPECTION REQUIREMENTS

#### General Notes:

Sub-clause numbers of tests and performance requirements refer to the "Sectional Specification, Publication IEC 60384-17 and Specific Reference Data".

#### Group C Inspection Requirements

| SUB-CLAUSE NUMBER AND TEST                          | CONDITIONS  | PERFORMANCE REQUIREMENTS  |
|---|---|---|
| <b>SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1</b> |   |   |
| 4.1 Dimensions (detail)                             |   | As specified in chapters "General Data" of this specification   |
| 4.3.1 Initial measurements                          | Capacitance<br>Tangent of loss angle at 100 kHz   |   |
| 4.14 Component solvent resistance                   | Isopropylalcohol at room temperature<br>Method: 2<br>Immersion time: $5 \pm 0.5$ min<br>Recovery time: Min. 1 h, max. 2 h |   |
| 4.4.2 Final measurements                            | Visual examination<br><br>Capacitance<br>Tangent of loss angle  | No visible damage<br>Legible marking<br>$ \Delta C/C  \leq 1 \%$ of the value measured initially<br>Increase of $\tan \delta$<br>$\leq 0.001$ for: $100 \text{ nF} < C \leq 470 \text{ nF}$ or<br>$\leq 0.0015$ for: $C > 470 \text{ nF}$<br>Compared to values measured in 4.3.1 |



AC and Pulse Double Metallized Polypropylene Vishay BCcomponents  
Film Capacitors MMKP Radial Potted Type

| SUB-CLAUSE NUMBER AND TEST   | CONDITIONS  | PERFORMANCE REQUIREMENTS   |  |
|--|---|--|--|
| <b>SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1</b>                  |   |  |  |
| 4.6.1 Initial measurements   | Capacitance   | No visible damage<br>Legible marking<br><br>No visible damage<br><br>No visible damage<br><br>No visible damage<br><br>No visible damage<br>$ \Delta C/C  \leq 1\%$ of the value measured in 4.6.1<br>Increase of $\tan \delta$<br>$\leq 0.001$ for: $100 \text{ nF} < C \leq 470 \text{ nF}$ or<br>$\leq 0.0015$ for: $C > 470 \text{ nF}$<br>Compared to values measured in 4.6.1<br>As specified in section "Insulation Resistance" of this specification |  |
| 4.15 Solvent resistance of the marking                                     | Tangent of loss angle at 100 kHz<br>Isopropylalcohol at room temperature<br>Method: 1<br>Rubbing material: Cotton wool<br>Immersion time: $5.0 \pm 0.5 \text{ min}$   |  |  |
| 4.6 Rapid change of temperature  | $\theta A = -55 \text{ }^\circ\text{C}$<br>$\theta B = +85 \text{ }^\circ\text{C}$<br>5 cycles<br>Duration $t = 30 \text{ min}$   |  |  |
| 4.7 Vibration  | Visual examination<br>Mounting:<br>See section "Mounting" for more information<br>Procedure B4<br>Frequency range: 10 Hz to 55 Hz<br>Amplitude: 0.75 mm or<br>Acceleration $98 \text{ m/s}^2$<br>(whichever is less severe)<br>Total duration 6 h |  |  |
| 4.7.2 Final inspection   | Visual examination  |  |  |
| 4.9 Shock  | Mounting:<br>See section "Mounting" for more information<br>Pulse shape: Half sine<br>Acceleration: $490 \text{ m/s}^2$<br>Duration of pulse: 11 ms   |  |  |
| 4.9.3 Final measurements   | Visual examination<br>Capacitance<br>Tangent of loss angle<br><br>Insulation resistance   |  |  |
| <b>SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B</b> |   |  |  |
| 4.10 Climatic sequence   | Temperature: $+85 \text{ }^\circ\text{C}$<br>Duration: 16 h   |  |  |
| 4.10.2 Dry heat  |   |  |  |
| 4.10.3 Damp heat cyclic<br>Test Db, first cycle                            | Temperature: $-55 \text{ }^\circ\text{C}$<br>Duration: 2 h  |  |  |
| 4.10.4 Cold  |   |  |  |
| 4.10.6 Damp heat cyclic<br>Test Db, remaining cycles                       | Voltage proof = $U_{Rdc}$ for 1 min within 15 min<br>after removal from testchamber<br>Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Insulation resistance  |  |  |
| 4.10.6.2 Final measurements  |   |  |  |
|  |   |  |  |

| SUB-CLAUSE NUMBER AND TEST                         | CONDITIONS  | PERFORMANCE REQUIREMENTS   |
|--|---|--|
| <b>SUB-GROUP C2</b>                                |   |  |
| 4.11 Damp heat steady state                        | 56 days, 40 °C, 90 % to 95 % RH<br>no load  | No breakdown of flashover<br><br>No visible damage<br>Legible marking<br>$ \Delta C/C  \leq 1\%$ of the value measured in 4.11.1.<br>Increase of $\tan \delta$<br>$\leq 0.001$ for: $100 \text{ nF} < C \leq 470 \text{ nF}$ or<br>$\leq 0.0015$ for: $C \leq 470 \text{ nF}$<br>Compared to values measured in 4.11.1<br>$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification |
| 4.11.1 Initial measurements                        | Capacitance<br>Tangent of loss angle at 1 kHz   |  |
| 4.11.3 Final measurements                          | Voltage proof = $U_{Rdc}$ for 1 min within 15 min after removal from testchamber<br>Visual examination            |  |
|  | Capacitance   |  |
|  | Tangent of loss angle   |  |
| <b>SUB-GROUP C3A</b>                               |   |  |
| 4.12.1 Endurance test at 50 Hz alternating voltage | Duration: 2000 h<br>Voltage: $1.25 \times U_{Rac}$ at 85 °C   | No visible damage<br>Legible marking<br>$ \Delta C/C  \leq 5\%$ compared to values measured in 4.12.1.1<br>Increase of $\tan \delta$<br>$\leq 0.001$ for: $100 \text{ nF} < C \leq 470 \text{ nF}$ or<br>$\leq 0.0015$ for: $C > 470 \text{ nF}$<br>Compared to values measured in 4.12.1.1<br>$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification                            |
| 4.12.1.1 Initial measurements                      | Capacitance<br>Tangent of loss angle at 100 kHz   |  |
| 4.12.1.3 Final measurements                        | Visual examination  |  |
|  | Capacitance   |  |
|  | Tangent of loss angle   |  |
| <b>SUB-GROUP C4</b>                                |   |  |
| 4.2.6 Temperature characteristics                  | Capacitance   | For - 55 °C to + 20 °C:<br>$+ 1\% \leq  \Delta C/C  \leq 3.75\%$ or<br>for 20 °C to 105 °C:<br>$- 6\% \leq  \Delta C/C  \leq 0\%$<br>As specified in section "Capacitance" of this specification.<br>As specified in section "Insulation Resistance" of this specification   |
| Initial measurements                               | Capacitance at - 55 °C  |  |
| Intermediate measurements                          | Capacitance at 20 °C  |  |
| Final measurements                                 | Capacitance at + 85 °C  |  |
|  | Capacitance   |  |
|  | Insulation resistance   |  |
| 4.13 Charge and discharge                          | 10 000 cycles<br>Charged to $U_{Rdc}$<br>Discharge resistance:<br>$R = \frac{U_{Rdc}}{5 \times C \times (dU/dt)}$ |  |
| 4.13.1 Initial measurements                        | Capacitance<br>Tangent of loss angle at 100 kHz   |  |
| 4.13.3 Final measurements                          | Capacitance   |  |
|  | Tangent of loss angle   |  |
|  | Insulation resistance   |  |
|  |   | $ \Delta C/C  \leq 1\%$ compared to values measured in 4.13.1<br>Increase of $\tan \delta$<br>$\leq 0.001$ for: $100 \text{ nF} < C \leq 470 \text{ nF}$ or<br>$\leq 0.0015$ for: $C > 470 \text{ nF}$<br>Compared to values measured in 4.13.1<br>$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification  |



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