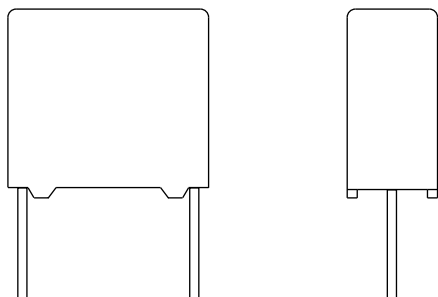




## Interference Suppression Film Capacitors - Class X2

### Radial MKP 310 V<sub>AC</sub> - Standard Across the Line

**FEATURES**

- 10 mm to 27.5 mm lead pitch
- Supplied loose in box, taped on reel
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

**RoHS**  
COMPLIANT**APPLICATIONS**

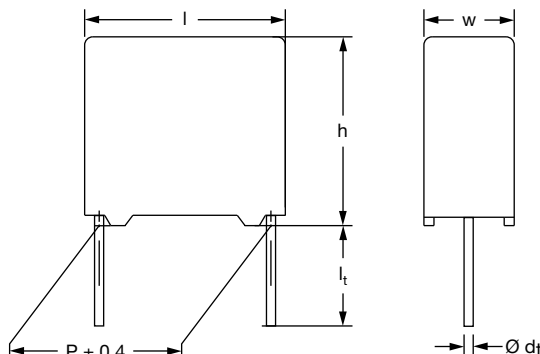
For standard across the line X2 applications

See also application note: [www.vishay.com/doc?28153](http://www.vishay.com/doc?28153)**QUICK REFERENCE DATA**

|                                                 |                                                                                                                                                                                                |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Capacitance range (E12 series)                  | 0.001 $\mu$ F to 2.2 $\mu$ F (preferred values acc. to E6)                                                                                                                                     |
| Capacitance tolerance                           | $\pm 20\%$ ; $\pm 10\%$ ; $\pm 5\%$                                                                                                                                                            |
| Climatic testing class according to IEC 60068-1 | 55/110/56/B                                                                                                                                                                                    |
| Rated AC voltage                                | 310 V <sub>AC</sub> ; 50 Hz to 60 Hz                                                                                                                                                           |
| Permissible DC voltage                          | 800 V <sub>DC</sub> at 85 °C, 630 V <sub>DC</sub> at 110 °C                                                                                                                                    |
| Maximum application temperature                 | C $\leq$ 470 nF: 110 °C (125 °C for less than 1000 h), C > 470 nF: 110 °C                                                                                                                      |
| Reference standards                             | IEC 60384-14 ed-4 (2013) and EN 60384-14<br>IEC 60065, pass. flamm. class B for volumes > 1750 mm <sup>3</sup><br>CQC GB/T6346.14-2015<br>UL 60384-14; CSA E384-14                             |
| Dielectric                                      | Polypropylene film                                                                                                                                                                             |
| Electrodes                                      | Metallized film                                                                                                                                                                                |
| Construction                                    | Mono construction<br>                                                                                      |
| Encapsulation                                   | Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0                                                                                                                              |
| Leads                                           | Tinned wire                                                                                                                                                                                    |
| Marking                                         | C-value; tolerance; rated voltage; sub-class; manufacturer's type designation;<br>code for dielectric material; manufacturer location; manufacturer's logo;<br>year and week; safety approvals |

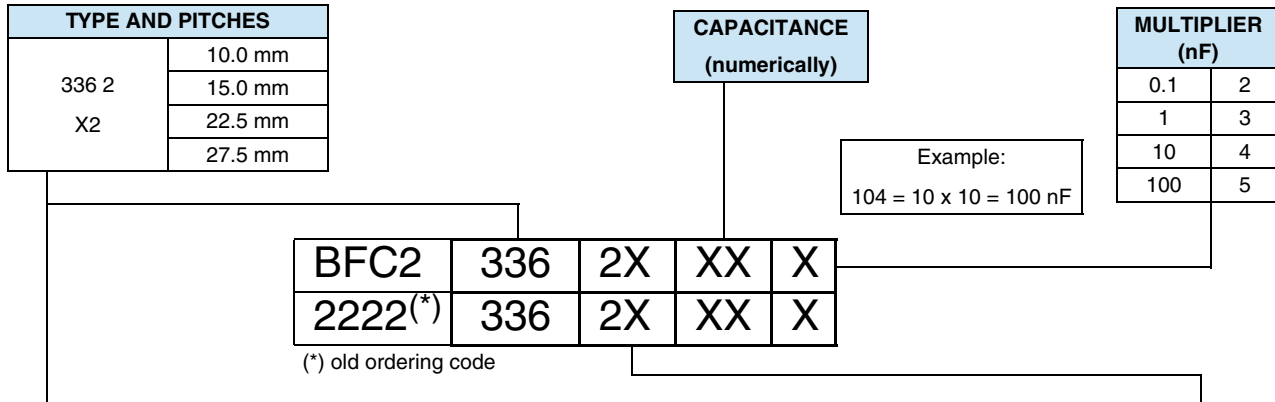
**Note**

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

**DIMENSIONS** in millimeters



## COMPOSITION OF CATALOG NUMBER



| TYPE        | PACKAGING                       | STANDARD DIMENSIONS                                   | C-TOL. | CODE NUMBER            |
|-------------|---------------------------------|-------------------------------------------------------|--------|------------------------|
| 336 2<br>X2 | Loose in box                    | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 20 % | BFC2 336 20...         |
|             |                                 | Lead length 5.0 mm ± 1.0 mm                           |        | See tables             |
|             |                                 | Lead length 25.0 mm ± 2.0 mm                          |        | BFC2 336 26...         |
|             | Taped on reel <sup>(1)</sup>    | H = 18.5 mm; P <sub>0</sub> = 12.7 mm                 |        | BFC2 336 23...         |
|             | Loose in box                    | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 10 % | BFC2 336 21...         |
|             |                                 | Lead length 5.0 mm ± 1.0 mm                           |        | See tables             |
|             |                                 | Lead length 25.0 mm ± 2.0 mm                          |        | BFC2 336 27...         |
|             | Taped on reel <sup>(1)</sup>    | H = 18.5 mm; P <sub>0</sub> = 12.7 mm                 |        | BFC2 336 24...         |
|             | Loose in box                    | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 5 %  | BFC2 336 22...         |
|             |                                 | Lead length 5.0 mm ± 1.0 mm                           |        | See tables             |
|             |                                 | Lead length 25.0 mm ± 2.0 mm                          |        | BFC2 336 28...         |
|             | Taped on reel <sup>(1)</sup>    | H = 18.5 mm; P <sub>0</sub> = 12.7 mm                 |        | BFC2 336 25...         |
|             | PACKAGING                       | ALTERNATIVE LARGER PITCH SIZES                        | C-TOL. | CODE NUMBER            |
|             | Loose in box                    | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 20 % | See tables for details |
|             |                                 | Lead length 5.0 mm ± 1.0 mm                           |        |                        |
|             |                                 | Lead length 25.0 mm ± 2.0 mm                          |        |                        |
|             | Taped on reel <sup>(1)</sup>    | H = 18.5 mm; P <sub>0</sub> = 12.7 mm                 |        |                        |
|             | Loose in box                    | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 10 % |                        |
|             |                                 | Lead length 5.0 mm ± 1.0 mm                           |        |                        |
|             |                                 | Lead length 25.0 mm ± 2.0 mm                          |        |                        |
|             | Taped on reel <sup>(1)(2)</sup> | H = 18.5 mm P <sub>0</sub> = 12.7 mm                  |        |                        |

## Notes

<sup>(1)</sup> For detailed tape specifications refer to packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139)

<sup>(2)</sup> Taped on reel pitch = 27.5 mm is not available



| SPECIFIC REFERENCE DATA                                                                                |                                      |                          |
|--------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------|
| DESCRIPTION                                                                                            | VALUE                                |                          |
| Rated AC voltage $U_{RAC}$                                                                             | 310 V                                |                          |
| Permissible DC voltage $U_{RDC}$                                                                       | 630 V                                |                          |
| Tangent of loss angle:                                                                                 | at 1 kHz                             | at 10 kHz                |
| $C < 470 \text{ nF}$                                                                                   | $\leq 10 \times 10^{-4}$             | $\leq 20 \times 10^{-4}$ |
| $470 \text{ nF} \leq C \leq 1 \text{ }\mu\text{F}$                                                     | $\leq 20 \times 10^{-4}$             | $\leq 70 \times 10^{-4}$ |
| $C > 1 \text{ }\mu\text{F}$                                                                            | $\leq 30 \times 10^{-4}$             | -                        |
| Rated voltage pulse slope $(dU/dt)_R$ at 435 $V_{DC}$                                                  | -                                    |                          |
| Pitch = 10 mm                                                                                          | 600 V/ $\mu\text{s}$                 |                          |
| Pitch = 15 mm and 7.5 mm (bent back)                                                                   | 400 V/ $\mu\text{s}$                 |                          |
| Pitch = 22.5 mm                                                                                        | 150 V/ $\mu\text{s}$                 |                          |
| Pitch = 27.5 mm                                                                                        | 100 V/ $\mu\text{s}$                 |                          |
| R between leads, for $C \leq 0.33 \text{ }\mu\text{F}$ at 100 V; 1 min                                 | $> 15\,000 \text{ M}\Omega$          |                          |
| RC between leads, for $C > 0.33 \text{ }\mu\text{F}$ at 100 V; 1 min                                   | $> 5000 \text{ s}$                   |                          |
| R between leads and case; 100 V; 1 min                                                                 | $> 30\,000 \text{ M}\Omega$          |                          |
| Withstanding (DC) voltage (cut off current 10 mA) <sup>(1)</sup> ; rise time $\leq 1000 \text{ V/s}$ : |                                      |                          |
| $C \leq 1 \text{ }\mu\text{F}$                                                                         | 2200 V; 1 min                        |                          |
| $C > 1 \text{ }\mu\text{F}$                                                                            | 1800 V; 1 min                        |                          |
| Withstanding (AC) voltage between leads and case                                                       | 2120 V; 1 min                        |                          |
| Max. application temperature for $0.001 \text{ }\mu\text{F} \leq C \leq 0.47 \text{ }\mu\text{F}$      | 110 °C (125 °C for less than 1000 h) |                          |
| Max. application temperature for $C > 0.47 \text{ }\mu\text{F}$                                        | 110 °C                               |                          |

**Note**

<sup>(1)</sup> See "Voltage Proof Test for Metalized Film Capacitors": [www.vishay.com/doc?28169](http://www.vishay.com/doc?28169)

| ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm |                                                                              |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|-------------------------------------------------|------------------------------------------------------------------------------|---------------------------------|----------------------------|---------------------------------------------|-------------------------------------|------|--------------------------------------|------|-----------------------------------------|------|
| U <sub>RAC</sub><br>(V)                         | CAP.<br>(μF)                                                                 | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) <sup>(3)</sup> | CATALOG NUMBER BFC2 336 ..... AND PACKAGING |                                     |      |                                      |      |                                         |      |
|                                                 |                                                                              |                                 |                            | LOOSE IN BOX                                |                                     |      |                                      |      | REEL (500 mm) <sup>(1)/(2)</sup>        |      |
|                                                 |                                                                              |                                 |                            | SHORT LEADS                                 |                                     |      | LONG LEADS                           |      | H = 18.5 mm<br>P <sub>0</sub> = 12.7 mm |      |
|                                                 |                                                                              |                                 |                            | l <sub>t</sub> = 3.5 mm<br>+ 1 mm/- 0.5 mm  | l <sub>t</sub> = 5.0 mm<br>± 1.0 mm | SPQ  | l <sub>t</sub> = 25.0 mm<br>± 2.0 mm | SPQ  |                                         | SPQ  |
| 310                                             | PITCH = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.6 mm ± 0.06 mm; C-TOL. = ± 20 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.0010                                                                       | 4.0 x 10.0 x 12.5               | 0.6                        | 20102                                       | 29131                               | 1000 | 26102                                | 1250 | 23102                                   | 1400 |
|                                                 | 0.0015                                                                       |                                 |                            | 20152                                       | 29132                               |      | 26152                                |      | 23152                                   |      |
|                                                 | 0.0022                                                                       |                                 |                            | 20222                                       | 29133                               |      | 26222                                |      | 23222                                   |      |
|                                                 | 0.0033                                                                       |                                 |                            | 20332                                       | 29134                               | 1000 | 26332                                | 1000 | 23332                                   | 1100 |
|                                                 | 0.0047                                                                       |                                 |                            | 20472                                       | 29135                               |      | 26472                                |      | 23472                                   |      |
|                                                 | 0.0068                                                                       |                                 |                            | 20682                                       | 29136                               |      | 26682                                |      | 23682                                   |      |
|                                                 | 0.010                                                                        |                                 |                            | 20103                                       | 29137                               |      | 26103                                |      | 23103                                   |      |
|                                                 | 0.015                                                                        |                                 |                            | 20153                                       | 29138                               |      | 26153                                |      | 23153                                   |      |
|                                                 | 0.022                                                                        |                                 |                            | 20223                                       | 29139                               |      | 26223                                |      | 23223                                   |      |
|                                                 | 0.033                                                                        | 20333                           | 29141                      | 750                                         | 26333                               | 750  | 23333                                | 900  |                                         |      |
|                                                 | PITCH = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.6 mm ± 0.06 mm; C-TOL. = ± 10 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.0010                                                                       | 4.0 x 10.0 x 12.5               | 0.6                        | 21102                                       | 29154                               | 1000 | 27102                                | 1250 | 24102                                   | 1400 |
|                                                 | 0.0012                                                                       |                                 |                            | 21122                                       | -                                   |      | 27122                                |      | 24122                                   |      |
|                                                 | 0.0015                                                                       |                                 |                            | 21152                                       | 29155                               |      | 27152                                |      | 24152                                   |      |
|                                                 | 0.0018                                                                       |                                 |                            | 21182                                       | -                                   |      | 27182                                |      | 24182                                   |      |
|                                                 | 0.0022                                                                       |                                 |                            | 21222                                       | 29156                               |      | 27222                                |      | 24222                                   |      |



| ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm |                                                                              |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|-------------------------------------------------|------------------------------------------------------------------------------|---------------------------------|----------------------------|---------------------------------------------|-------------------------------------|------|--------------------------------------|------|-----------------------------------------|------|
| U <sub>RAC</sub><br>(V)                         | CAP.<br>(μF)                                                                 | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) <sup>(3)</sup> | CATALOG NUMBER BFC2 336 ..... AND PACKAGING |                                     |      |                                      |      |                                         |      |
|                                                 |                                                                              |                                 |                            | LOOSE IN BOX                                |                                     |      |                                      |      | REEL (500 mm) <sup>(1)(2)</sup>         |      |
|                                                 |                                                                              |                                 |                            | SHORT LEADS                                 |                                     |      | LONG LEADS                           |      | H = 18.5 mm<br>P <sub>0</sub> = 12.7 mm |      |
|                                                 |                                                                              |                                 |                            | l <sub>t</sub> = 3.5 mm<br>+ 1 mm/- 0.5 mm  | l <sub>t</sub> = 5.0 mm<br>± 1.0 mm | SPQ  | l <sub>t</sub> = 25.0 mm<br>± 2.0 mm | SPQ  |                                         | SPQ  |
| 310                                             | PITCH = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.6 mm ± 0.06 mm; C-TOL. = ± 10 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.0027                                                                       | 4.0 x 10.0 x 12.5               | 0.6                        | 21272                                       | -                                   | 1000 | 27272                                | 1000 | 24272                                   | 1100 |
|                                                 | 0.0033                                                                       |                                 |                            | 21332                                       | 29157                               |      | 27332                                |      | 24332                                   |      |
|                                                 | 0.0039                                                                       |                                 |                            | 21392                                       | -                                   |      | 27392                                |      | 24392                                   |      |
|                                                 | 0.0047                                                                       |                                 |                            | 21472                                       | 29158                               |      | 27472                                |      | 24472                                   |      |
|                                                 | 0.0056                                                                       |                                 |                            | 21562                                       | -                                   |      | 27562                                |      | 24562                                   |      |
|                                                 | 0.0068                                                                       |                                 |                            | 21682                                       | 29159                               |      | 27682                                |      | 24682                                   |      |
|                                                 | 0.0082                                                                       |                                 |                            | 21822                                       | -                                   |      | 27822                                |      | 24822                                   |      |
|                                                 | 0.010                                                                        |                                 |                            | 21103                                       | 29161                               |      | 27103                                |      | 24103                                   |      |
|                                                 | 0.012                                                                        |                                 |                            | 21123                                       | -                                   |      | 27123                                |      | 24123                                   |      |
|                                                 | 0.015                                                                        |                                 |                            | 21153                                       | 29162                               |      | 27153                                |      | 24153                                   |      |
|                                                 | 0.018                                                                        |                                 |                            | 21183                                       | -                                   |      | 27183                                |      | 24183                                   |      |
|                                                 | 0.022                                                                        |                                 |                            | 21223                                       | 29163                               |      | 27223                                |      | 24223                                   |      |
|                                                 | 0.027                                                                        | 21273                           | -                          | 27273                                       | 24273                               |      |                                      |      |                                         |      |
|                                                 | 0.033                                                                        | 21333                           | 29164                      | 750                                         | 27333                               | 750  | 24333                                | 900  |                                         |      |
|                                                 | PITCH = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.6 mm ± 0.06 mm; C-TOL. = ± 5 %  |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.0010                                                                       | 4.0 x 10.0 x 12.5               | 0.6                        | 22102                                       | -                                   | 1000 | 28102                                | 1250 | 25102                                   | 1400 |
|                                                 | 0.0012                                                                       |                                 |                            | 22122                                       | -                                   |      | 28122                                |      | 25122                                   |      |
|                                                 | 0.0015                                                                       |                                 |                            | 22152                                       | -                                   |      | 28152                                |      | 25152                                   |      |
|                                                 | 0.0018                                                                       |                                 |                            | 22182                                       | -                                   |      | 28182                                |      | 25182                                   |      |
|                                                 | 0.0022                                                                       |                                 |                            | 22222                                       | -                                   |      | 28222                                |      | 25222                                   |      |
|                                                 | 0.0027                                                                       |                                 |                            | 22272                                       | -                                   | 1000 | 28272                                | 1000 | 25272                                   | 1100 |
|                                                 | 0.0033                                                                       |                                 |                            | 22332                                       | -                                   |      | 28332                                |      | 25332                                   |      |
|                                                 | 0.0039                                                                       |                                 |                            | 22392                                       | -                                   |      | 28392                                |      | 25392                                   |      |
|                                                 | 0.0047                                                                       |                                 |                            | 22472                                       | -                                   |      | 28472                                |      | 25472                                   |      |
|                                                 | 0.0056                                                                       |                                 |                            | 22562                                       | -                                   |      | 28562                                |      | 25562                                   |      |
|                                                 | 0.0068                                                                       |                                 |                            | 22682                                       | -                                   |      | 28682                                |      | 25682                                   |      |
|                                                 | 0.0082                                                                       |                                 |                            | 22822                                       | -                                   |      | 28822                                |      | 25822                                   |      |
|                                                 | 0.010                                                                        |                                 |                            | 22103                                       | -                                   |      | 28103                                |      | 25103                                   |      |
|                                                 | 0.012                                                                        |                                 |                            | 22123                                       | -                                   |      | 28123                                |      | 25123                                   |      |
|                                                 | 0.015                                                                        |                                 |                            | 22153                                       | -                                   |      | 28153                                |      | 25153                                   |      |
|                                                 | 0.018                                                                        |                                 |                            | 22183                                       | -                                   |      | 28183                                |      | 25183                                   |      |
|                                                 | 0.022                                                                        |                                 |                            | 22223                                       | -                                   |      | 28223                                |      | 25223                                   |      |
|                                                 | 0.027                                                                        |                                 |                            | 22273                                       | -                                   | 750  | 28273                                | 750  | 25273                                   | 900  |
| 0.033                                           | 22333                                                                        |                                 |                            | -                                           | 28333                               |      | 25333                                |      |                                         |      |

**Notes**

- SPQ = Standard Packing Quantity

(1) H = In-tape height; P<sub>0</sub> = sprocket hole distance; for detailed specifications refer to packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139)

(2) Reel diameter = 356 mm is available on request

(3) Weight for short lead product only



| ELECTRICAL DATA AND ORDERING CODE - PITCH 15 mm |                                                                          |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|-------------------------------------------------|--------------------------------------------------------------------------|---------------------------------|----------------------------|---------------------------------------------|-------------------------------------|------|--------------------------------------|------|-----------------------------------------|------|
| U <sub>RAC</sub><br>(V)                         | CAP.<br>(μF)                                                             | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) <sup>(3)</sup> | CATALOG NUMBER BFC2 336 ..... AND PACKAGING |                                     |      |                                      |      |                                         |      |
|                                                 |                                                                          |                                 |                            | LOOSE IN BOX                                |                                     |      |                                      |      | REEL (500 mm) <sup>(1)/(2)</sup>        |      |
|                                                 |                                                                          |                                 |                            | SHORT LEADS                                 |                                     |      | LONG LEADS                           |      | H = 18.5 mm<br>P <sub>0</sub> = 12.7 mm |      |
|                                                 |                                                                          |                                 |                            | l <sub>t</sub> = 3.5 mm<br>± 0.3 mm         | l <sub>t</sub> = 5.0 mm<br>± 1.0 mm | SPQ  | l <sub>t</sub> = 25.0 mm<br>± 2.0 mm | SPQ  |                                         | SPQ  |
| 310                                             | PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.60 ± 0.06 mm; C-TOL. = ± 20 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.010                                                                    | 5.0 x 11.0 x 17.5               | 0.98                       | 29001                                       | 29273                               | 1000 | 29097                                | 1000 | 29004                                   | 1100 |
|                                                 | 0.015                                                                    |                                 |                            | 29011                                       | 29274                               |      | 29071                                |      | 29014                                   |      |
|                                                 | 0.022                                                                    |                                 |                            | 29021                                       | 29275                               |      | 29076                                |      | 29024                                   |      |
|                                                 | 0.033                                                                    |                                 |                            | 29031                                       | 29276                               |      | 29082                                |      | 29034                                   |      |
|                                                 | 0.047                                                                    |                                 |                            | 20473                                       | 29142                               |      | 26473                                |      | 23473                                   |      |
|                                                 | 0.068                                                                    |                                 |                            | 20683                                       | 29143                               |      | 26683                                |      | 23683                                   |      |
|                                                 | 0.10                                                                     | 6.0 x 12.0 x 17.5               | 1.4                        | 20104                                       | 29144                               |      | 26104                                | 500  | 23104                                   | 900  |
|                                                 | 0.15                                                                     |                                 |                            | 20154                                       | 29145                               |      | 26154                                |      | 23154                                   | 650  |
|                                                 | PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.80 ± 0.08 mm; C-TOL. = ± 20 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.22                                                                     | 7.0 x 13.5 x 17.5               | 1.8                        | 20224                                       | 29146                               | 500  | 26224                                | 500  | 23224                                   | 600  |
|                                                 | PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.60 ± 0.06 mm; C-TOL. = ± 10 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.010                                                                    | 5.0 x 11.0 x 17.5               | 0.98                       | 29002                                       | 29281                               | 1000 | 29066                                | 1000 | 29005                                   | 1100 |
|                                                 | 0.012                                                                    |                                 |                            | 29007                                       | -                                   |      | 29068                                |      | 29009                                   |      |
|                                                 | 0.015                                                                    |                                 |                            | 29012                                       | 29282                               |      | 29072                                |      | 29015                                   |      |
|                                                 | 0.018                                                                    |                                 |                            | 29017                                       | -                                   |      | 29074                                |      | 29019                                   |      |
|                                                 | 0.022                                                                    |                                 |                            | 29022                                       | 29283                               |      | 29077                                |      | 29025                                   |      |
|                                                 | 0.027                                                                    |                                 |                            | 29027                                       | -                                   |      | 29079                                |      | 29029                                   |      |
|                                                 | 0.033                                                                    |                                 |                            | 29032                                       | 29284                               |      | 29083                                |      | 29035                                   |      |
|                                                 | 0.039                                                                    |                                 |                            | 21393                                       | -                                   |      | 27393                                |      | 24393                                   |      |
|                                                 | 0.047                                                                    |                                 |                            | 21473                                       | 29165                               |      | 27473                                |      | 24473                                   |      |
|                                                 | 0.056                                                                    |                                 |                            | 21563                                       | -                                   |      | 27563                                |      | 24563                                   |      |
|                                                 | 0.068                                                                    |                                 |                            | 21683                                       | 29166                               |      | 27683                                |      | 24683                                   | 900  |
|                                                 | 0.082                                                                    |                                 |                            | 21823                                       | -                                   |      | 27823                                |      | 24823                                   |      |
|                                                 | 0.10                                                                     |                                 |                            | 21104                                       | 29167                               |      | 27104                                |      | 24104                                   |      |
|                                                 | 0.12                                                                     | 6.0 x 12.0 x 17.5               | 1.4                        | 21124                                       | -                                   |      | 27124                                | 500  | 24124                                   | 650  |
|                                                 | 0.15                                                                     |                                 |                            | 21154                                       | 29168                               |      | 27154                                |      | 24154                                   |      |
|                                                 | PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.80 ± 0.08 mm; C-TOL. = ± 10 % |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.18                                                                     | 7.0 x 13.5 x 17.5               | 1.8                        | 21184                                       | -                                   | 500  | 27184                                | 500  | 24184                                   | 600  |
|                                                 | 0.22                                                                     |                                 |                            | 21224                                       | 29169                               |      | 27224                                |      | 24224                                   |      |
|                                                 | PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.60 ± 0.06 mm; C-TOL. = ± 5 %  |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.010                                                                    | 5.0 x 11.0 x 17.5               | 0.98                       | 29003                                       | -                                   | 1000 | 29067                                | 1000 | 29006                                   | 1100 |
|                                                 | 0.012                                                                    |                                 |                            | 29008                                       | -                                   |      | 29069                                |      | 29061                                   |      |
|                                                 | 0.015                                                                    |                                 |                            | 29013                                       | -                                   |      | 29073                                |      | 29016                                   |      |
|                                                 | 0.018                                                                    |                                 |                            | 29018                                       | -                                   |      | 29075                                |      | 29062                                   |      |
|                                                 | 0.022                                                                    |                                 |                            | 29023                                       | -                                   |      | 29078                                |      | 29026                                   |      |
|                                                 | 0.027                                                                    |                                 |                            | 29028                                       | -                                   |      | 29081                                |      | 29063                                   |      |
|                                                 | 0.033                                                                    |                                 |                            | 29033                                       | -                                   |      | 29084                                |      | 29036                                   |      |
|                                                 | 0.039                                                                    |                                 |                            | 22393                                       | -                                   |      | 28393                                |      | 25393                                   |      |
|                                                 | 0.047                                                                    |                                 |                            | 22473                                       | -                                   |      | 28473                                |      | 25473                                   |      |
|                                                 | 0.056                                                                    |                                 |                            | 22563                                       | -                                   |      | 28563                                |      | 25563                                   |      |
|                                                 | 0.068                                                                    |                                 |                            | 22683                                       | -                                   |      | 28683                                |      | 25683                                   | 900  |
|                                                 | 0.082                                                                    |                                 |                            | 22823                                       | -                                   |      | 28823                                |      | 25823                                   |      |
|                                                 | 0.10                                                                     |                                 |                            | 22104                                       | -                                   |      | 28104                                |      | 25104                                   |      |
|                                                 | 0.12                                                                     | 6.0 x 12.0 x 17.5               | 1.4                        | 22124                                       | -                                   |      | 28124                                | 500  | 25124                                   | 650  |
|                                                 | 0.15                                                                     |                                 |                            | 22154                                       | -                                   |      | 28154                                |      | 25154                                   |      |
|                                                 | PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.80 ± 0.08 mm; C-TOL. = ± 5 %  |                                 |                            |                                             |                                     |      |                                      |      |                                         |      |
|                                                 | 0.18                                                                     | 7.0 x 13.5 x 17.5               | 1.8                        | 22184                                       | -                                   | 500  | 28184                                | 500  | 25184                                   | 600  |

## Notes

- SPQ = Standard Packing Quantity

(1) H = In-tape height; P<sub>0</sub> = sprocket hole distance; for detailed specifications refer to packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139)

(2) Reel diameter = 356 mm is available on request

(3) Weight for short lead product only



| ELECTRICAL DATA AND ORDERING CODE - PITCH 22.5 mm |                                                                               |                                 |                            |                                             |                                     |     |                                      |     |                                         |     |
|---------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------|----------------------------|---------------------------------------------|-------------------------------------|-----|--------------------------------------|-----|-----------------------------------------|-----|
| U <sub>RAC</sub><br>(V)                           | CAP.<br>(μF)                                                                  | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) <sup>(3)</sup> | CATALOG NUMBER BFC2 336 ..... AND PACKAGING |                                     |     |                                      |     |                                         |     |
|                                                   |                                                                               |                                 |                            | LOOSE IN BOX                                |                                     |     |                                      |     | REEL (500 mm) <sup>(1)(2)</sup>         |     |
|                                                   |                                                                               |                                 |                            | SHORT LEADS                                 |                                     |     | LONG LEADS                           |     | H = 18.5 mm<br>P <sub>0</sub> = 12.7 mm |     |
|                                                   |                                                                               |                                 |                            | l <sub>t</sub> = 3.5 mm<br>± 0.3 mm         | l <sub>t</sub> = 5.0 mm<br>± 1.0 mm | SPQ | l <sub>t</sub> = 25.0 mm<br>± 2.0 mm | SPQ |                                         | SPQ |
| 310                                               | PITCH = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 % |                                 |                            |                                             |                                     |     |                                      |     |                                         |     |
|                                                   | 0.15                                                                          | 6.0 x 15.5 x 26.0               | 2.4                        | 29041                                       | 29277                               | 300 | 29087                                | 500 | 29044                                   | 600 |
|                                                   | 0.22                                                                          |                                 |                            | 29051                                       | 29278                               |     | 29093                                |     | 29053                                   | 550 |
|                                                   | 0.33                                                                          |                                 |                            | 20334                                       | 29147                               |     | 26334                                |     | 23334                                   | 450 |
|                                                   | 0.47                                                                          | 7.0 x 16.5 x 26.0               | 2.9                        | 20474                                       | 29148                               | 200 | 26474                                | 500 | 23474                                   | 400 |
|                                                   | PITCH = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 % |                                 |                            |                                             |                                     |     |                                      |     |                                         |     |
|                                                   | 0.12                                                                          | 6.0 x 15.5 x 26.0               | 2.4                        | 29037                                       | -                                   | 300 | 29085                                | 500 | 29039                                   | 600 |
|                                                   | 0.15                                                                          |                                 |                            | 29042                                       | 29285                               |     | 29088                                |     | 29045                                   |     |
|                                                   | 0.18                                                                          |                                 |                            | 29047                                       | -                                   |     | 29091                                |     | 29049                                   | 550 |
|                                                   | 0.22                                                                          |                                 |                            | 29052                                       | 29286                               |     | 29094                                |     | 29054                                   |     |
|                                                   | 0.27                                                                          |                                 |                            | 21274                                       | -                                   |     | 27274                                |     | 24274                                   | 450 |
|                                                   | 0.33                                                                          |                                 |                            | 21334                                       | 29171                               |     | 27334                                |     | 24334                                   |     |
|                                                   | 0.39                                                                          | 7.0 x 16.5 x 26.0               | 2.9                        | 21394                                       | -                                   | 200 | 27394                                |     | 24394                                   | 400 |
|                                                   | 0.47                                                                          |                                 |                            | 21474                                       | 29172                               |     | 27474                                |     | 24474                                   |     |
|                                                   | PITCH = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %  |                                 |                            |                                             |                                     |     |                                      |     |                                         |     |
|                                                   | 0.12                                                                          | 6.0 x 15.5 x 26.0               | 2.4                        | 29038                                       | -                                   | 300 | 29086                                | 500 | 29064                                   | 600 |
|                                                   | 0.15                                                                          |                                 |                            | 29043                                       | -                                   |     | 29089                                |     | 29046                                   |     |
|                                                   | 0.18                                                                          |                                 |                            | 29048                                       | -                                   |     | 29092                                |     | 29065                                   | 550 |
|                                                   | 0.22                                                                          |                                 |                            | 22224                                       | -                                   |     | 28224                                |     | 25224                                   |     |
|                                                   | 0.27                                                                          |                                 |                            | 22274                                       | -                                   |     | 28274                                |     | 25274                                   | 450 |
|                                                   | 0.33                                                                          | 7.0 x 16.5 x 26.0               | 2.9                        | 22334                                       | -                                   | 200 | 28334                                |     | 25334                                   |     |
|                                                   | 0.39                                                                          |                                 |                            | 22394                                       | -                                   |     | 28394                                |     | 25394                                   | 400 |

**Notes**

- SPQ = Standard Packing Quantity

(1) H = In-tape height; P<sub>0</sub> = sprocket hole distance; for detailed specifications refer to packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139)

(2) Reel diameter = 356 mm is available on request

(3) Weight for short lead product only



| ELECTRICAL DATA AND ORDERING CODE - PITCH 27.5 mm |                                                                               |                                 |                            |                                             |                                     |       |                                      |     |
|---------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------|----------------------------|---------------------------------------------|-------------------------------------|-------|--------------------------------------|-----|
| U <sub>RAC</sub><br>(V)                           | CAP.<br>(μF)                                                                  | DIMENSIONS<br>w x h x l<br>(mm) | MASS<br>(g) <sup>(1)</sup> | CATALOG NUMBER BFC2 336 ..... AND PACKAGING |                                     |       |                                      |     |
|                                                   |                                                                               |                                 |                            | LOOSE IN BOX                                |                                     |       |                                      |     |
|                                                   |                                                                               |                                 |                            | SHORT LEADS                                 |                                     |       | LONG LEADS                           |     |
|                                                   |                                                                               |                                 |                            | l <sub>t</sub> = 3.5 mm<br>± 0.3 mm         | l <sub>t</sub> = 5.0 mm<br>± 1.0 mm | SPQ   | l <sub>t</sub> = 25.0 mm<br>± 2.0 mm | SPQ |
| 310                                               | PITCH = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 % |                                 |                            |                                             |                                     |       |                                      |     |
|                                                   | 0.47                                                                          | 9.0 x 19.0 x 31.5               | 5.5                        | 29055                                       | 29279                               | 100   | 29095                                | 150 |
|                                                   | 0.68                                                                          |                                 |                            | 20684                                       | 29149                               |       | 26684                                | 125 |
|                                                   | 1.0                                                                           | 11.0 x 21.0 x 31.0              | 7.4                        | 20105                                       | 29151                               |       | 26105                                |     |
|                                                   | 1.5                                                                           | 13.0 x 23.0 x 31.0              | 9.2                        | 20155                                       | 29152                               |       | 26155                                |     |
|                                                   | 2.2                                                                           | 15.0 x 25.0 x 31.5              | 12.3                       | 20225                                       | 29153                               |       | 26225                                | 75  |
|                                                   | PITCH = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 % |                                 |                            |                                             |                                     |       |                                      |     |
|                                                   | 0.47                                                                          | 9.0 x 19.0 x 31.5               | 5.5                        | 29056                                       | 29287                               | 100   | 29096                                | 150 |
|                                                   | 0.56                                                                          |                                 |                            | 21564                                       | -                                   |       | 27564                                | 125 |
|                                                   | 0.68                                                                          | 11.0 x 21.0 x 31.0              | 7.4                        | 21684                                       | 29173                               |       | 27684                                |     |
|                                                   | 0.82                                                                          |                                 |                            | 21824                                       | -                                   |       | 27824                                |     |
|                                                   | 1.0                                                                           | 21105                           | 29174                      | 27105                                       |                                     |       |                                      |     |
|                                                   | 1.2                                                                           | 13.0 x 23.0 x 31.0              | 9.2                        | 21125                                       | -                                   |       | 27125                                | 75  |
|                                                   | 1.5                                                                           |                                 |                            | 21155                                       | 29175                               |       | 27155                                |     |
|                                                   | 1.8                                                                           | 15.0 x 25.0 x 31.5              | 12.3                       | 21185                                       | -                                   | 27185 | 75                                   |     |
|                                                   | 2.2                                                                           |                                 |                            | 21225                                       | 29176                               | 27225 |                                      |     |
|                                                   | PITCH = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %  |                                 |                            |                                             |                                     |       |                                      |     |
|                                                   | 0.47                                                                          | 9.0 x 19.0 x 31.5               | 5.5                        | 22474                                       | -                                   | 100   | 28474                                | 125 |
|                                                   | 0.56                                                                          |                                 |                            | 22564                                       | -                                   |       | 28564                                |     |
|                                                   | 0.68                                                                          |                                 |                            | 22684                                       | -                                   |       | 28684                                |     |
|                                                   | 0.82                                                                          | 11.0 x 21.0 x 31.0              | 7.4                        | 22824                                       | -                                   |       | 28824                                |     |
|                                                   | 1.0                                                                           |                                 |                            | 22105                                       | -                                   |       | 28105                                |     |
|                                                   | 1.2                                                                           | 13.0 x 23.0 x 31.0              | 9.2                        | 22125                                       | -                                   |       | 28125                                | 75  |
|                                                   | 1.5                                                                           |                                 |                            | 22155                                       | -                                   |       | 28155                                |     |
|                                                   | 1.8                                                                           | 15.0 x 25.0 x 31.5              | 12.3                       | 22185                                       | -                                   | 100   | 28185                                | 75  |
|                                                   | 2.2                                                                           |                                 |                            | 22225                                       | -                                   |       | 28225                                |     |

**Notes**

- SPQ = Standard Packing Quantity
- <sup>(1)</sup> Weight for short lead product only



| APPROVALS                                                                                                                                                                                                                                                                                                                                                           |                     |                |                    |                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|--------------------|------------------------------------------------------------------------|
| SAFETY APPROVALS X2                                                                                                                                                                                                                                                                                                                                                 | VOLTAGE             | VALUE          | FILE NUMBERS       | LINK                                                                   |
| EN 60384-14 (ENEC)<br>(= IEC 60384-14 ed-4 (2013))                                                                                                                                                                                                                                                                                                                  | 310 V <sub>AC</sub> | 1 nF to 2.2 µF | ENEC16/FI/19/10001 | <a href="http://www.vishay.com/doc?28179">www.vishay.com/doc?28179</a> |
| UL 60384-14                                                                                                                                                                                                                                                                                                                                                         | 310 V <sub>AC</sub> | 1 nF to 2.2 µF | E354331            | <a href="http://www.vishay.com/doc?28184">www.vishay.com/doc?28184</a> |
| CSA-E 384-14                                                                                                                                                                                                                                                                                                                                                        | 310 V <sub>AC</sub> | 1 nF to 2.2 µF | E354331            |                                                                        |
| CQC GB/T6346.14-2015                                                                                                                                                                                                                                                                                                                                                | 310 V <sub>AC</sub> | 1 nF to 2.2 µF | CQC07001021280 (L) | <a href="http://www.vishay.com/doc?28199">www.vishay.com/doc?28199</a> |
|                                                                                                                                                                                                                                                                                                                                                                     |                     |                | CQC04001009262 (F) | <a href="http://www.vishay.com/doc?28200">www.vishay.com/doc?28200</a> |
| CB test certificate                                                                                                                                                                                                                                                                                                                                                 | 310 V <sub>AC</sub> | 1 nF to 2.2 µF | FI-39827           | <a href="http://www.vishay.com/doc?28175">www.vishay.com/doc?28175</a> |
| The ENEC-approval together with the CB-certificate replace all national marks of the following countries (they have already signed the ENEC-agreement): Austria; Belgium; Czech. Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Norway; Portugal; Slovenian; Spain; Sweden; Switzerland and United Kingdom. |                     |                |                    |                                                                        |
|                                                                                                                |                     |                |                    |                                                                        |

## MOUNTING

### Normal Use

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

For detailed tape specifications refer to packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139)

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

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

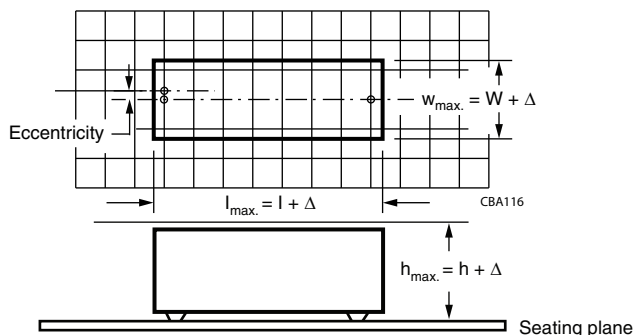
- For pitches  $\leq 15$  mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped.

### Space Requirements on Printed Circuit Board

The maximum space for length ( $l_{max.}$ ), width ( $w_{max.}$ ) and height ( $h_{max.}$ ) of film capacitors to take in account on the printed circuit board is shown in the drawings.

- For products with pitch  $\leq 15$  mm,  $\Delta w = \Delta l = 0.3$  mm;  $\Delta h = 0.1$  mm
- For products with  $15$  mm  $<$  pitch  $\leq 27.5$  mm,  $\Delta w = \Delta l = 0.5$  mm;  $\Delta h = 0.1$  mm

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



## 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](http://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

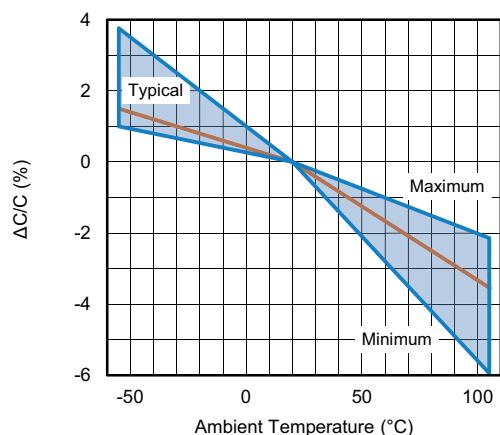
Unless otherwise specified, all electrical values apply to an ambient temperature of  $23$  °C  $\pm 1$  °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 %  $\pm 2$  %.

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

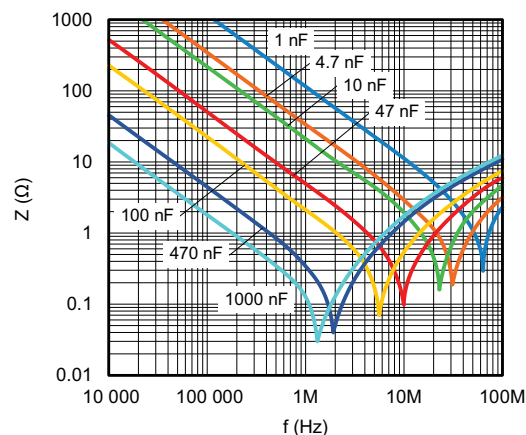




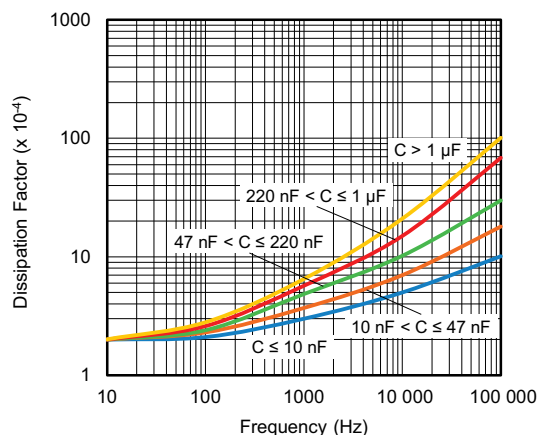
# CHARACTERISTICS



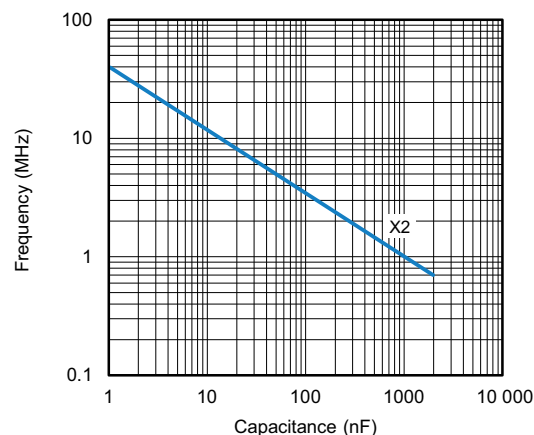
Capacitance as a function of ambient temperature (typical curve)



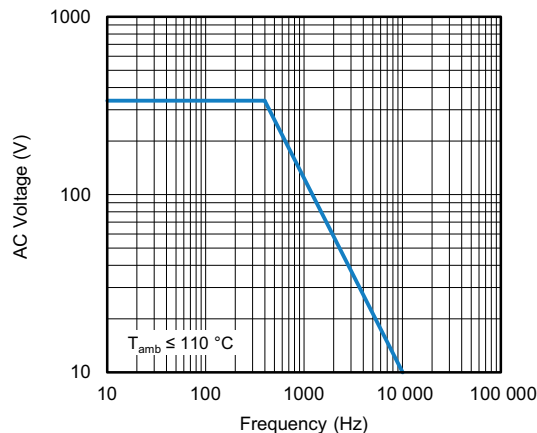
Impedance as a function of frequency (typical curve)



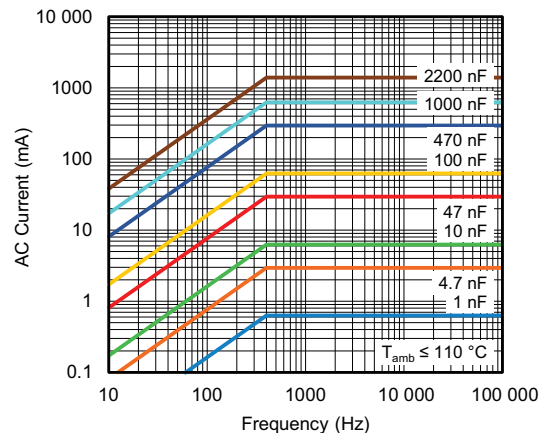
Tangent of loss angle as a function of frequency (typical curve)



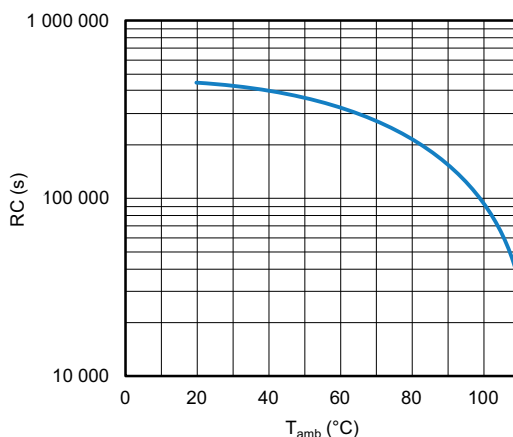
Resonant frequency as a function of capacitance (typical curve)



Max. RMS voltage as a function of frequency (typical curve)



Max. RMS current as a function of frequency (typical curve)



Insulation resistance as a function of ambient temperature

**APPLICATION NOTES**

- For X2 electromagnetic interference suppression in **standard across the line applications** (50 Hz / 60 Hz) with a maximum mains voltage of 310 V<sub>AC</sub>
- For series impedance applications we refer to the application note [www.vishay.com/doc?28153](http://www.vishay.com/doc?28153)
- 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: [rfi@vishay.com](mailto:rfi@vishay.com)
- These capacitors are not intended for continuous pulse applications. For these situations, capacitors of the AC and pulse programs must be used
- The maximum ambient temperature must not exceed 110 °C (125 °C for less than 1000 h) for C ≤ 470 nF and 110 °C for C > 470 nF
- Rated voltage pulse slope:  
if the pulse voltage is lower than the rated voltage, the values of the specific reference data can be multiplied by 435 V<sub>DC</sub> and divided by the applied voltage

**INSPECTION REQUIREMENTS****General Notes**

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, IEC Publication IEC 60384-14 ed-4 (2013) and Specific Reference Data”.

| <b>GROUP C INSPECTION REQUIREMENTS</b>              |                                                                                          |                                                               |
|-----------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <b>SUB-CLAUSE NUMBER AND TEST</b>                   | <b>CONDITIONS</b>                                                                        | <b>PERFORMANCE REQUIREMENTS</b>                               |
| <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 |
| Initial measurements                                | Capacitance<br>Tangent of loss angle:<br>For C ≤ 1 µF at 10 kHz<br>For C > 1 µF at 1 kHz |                                                               |
| 4.3 Robustness of terminations                      | Tensile: Load 10 N; 10 s<br>Bending: Load 5 N; 4 x 90°                                   | No visible damage                                             |
| 4.4 Resistance to soldering heat                    | No pre-drying<br>Method: 1A<br>Solder bath: 280 °C ± 5 °C<br>Duration: 10 s              |                                                               |



| <b>GROUP C INSPECTION REQUIREMENTS</b>                                      |                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SUB-CLAUSE NUMBER AND TEST</b>                                           | <b>CONDITIONS</b>                                                                                                                                                                                                         | <b>PERFORMANCE REQUIREMENTS</b>                                                                                                                                                                                                                                                                                                                        |
| <b>SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1</b>                         |                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                        |
| 4.19 Component solvent resistance                                           | Isopropylalcohol at room temperature<br>Method: 2<br>Immersion time: 5 min ± 0.5 min<br>Recovery time:<br>Min. 1 h, max. 2 h                                                                                              |                                                                                                                                                                                                                                                                                                                                                        |
| 4.4.2 Final measurements                                                    | Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Insulation resistance                                                                                                                           | No visible damage<br>Legible marking<br><br>$ \Delta C/C  \leq 5\%$ of the value measured initially<br><br>Increase of $\tan \delta$ :<br>$\leq 0.008$ for: $C \leq 1\ \mu\text{F}$ or<br>$\leq 0.005$ for: $C > 1\ \mu\text{F}$<br>Compared to values measured initially<br><br>As specified in section "Insulation resistance" of this specification |
| <b>SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1</b>                         |                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                        |
| Initial measurements                                                        | Capacitance<br>Tangent of loss angle:<br>For $C \leq 1\ \mu\text{F}$ at 10 kHz<br>For $C > 1\ \mu\text{F}$ at 1 kHz                                                                                                       |                                                                                                                                                                                                                                                                                                                                                        |
| 4.20 Solvent resistance of the marking: see section "General notes"; item 5 | Isopropylalcohol at room temperature<br>Method: 1<br>Rubbing material: Cotton wool<br>Immersion time: 5 min ± 0.5 min                                                                                                     | No visible damage<br>Legible marking                                                                                                                                                                                                                                                                                                                   |
| 4.6 Rapid change of temperature                                             | $\theta A = -55\ ^\circ\text{C}$<br>$\theta B = +110\ ^\circ\text{C}$<br>5 cycles<br>Duration $t = 30\ \text{min}$                                                                                                        |                                                                                                                                                                                                                                                                                                                                                        |
| 4.6.1 Inspection                                                            | Visual examination                                                                                                                                                                                                        | No visible damage                                                                                                                                                                                                                                                                                                                                      |
| 4.7 Vibration                                                               | Mounting: 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 $98\ \text{m/s}^2$<br>(whichever is less severe)<br>Total duration 6 h |                                                                                                                                                                                                                                                                                                                                                        |
| 4.7.2 Final inspection                                                      | Visual examination                                                                                                                                                                                                        | No visible damage                                                                                                                                                                                                                                                                                                                                      |
| 4.9 Shock                                                                   | Mounting: See section "Mounting" for more information<br>Pulse shape: Half sine<br>Acceleration: $490\ \text{m/s}^2$<br>Duration of pulse: 11 ms                                                                          |                                                                                                                                                                                                                                                                                                                                                        |

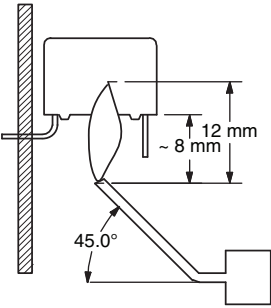


| <b>GROUP C INSPECTION REQUIREMENTS</b>                                     |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SUB-CLAUSE NUMBER AND TEST</b>                                          | <b>CONDITIONS</b>                                                                                                                                                         | <b>PERFORMANCE REQUIREMENTS</b>                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1</b>                        |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.9.2 Final measurements                                                   | Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Insulation resistance                                                                           | No visible damage<br><br>$ \Delta C/C  \leq 5\%$ of the value measured initially<br><br>Increase of $\tan \delta$ :<br>$\leq 0.008$ for: $C \leq 1\ \mu\text{F}$ or<br>$\leq 0.005$ for: $C > 1\ \mu\text{F}$<br>Compared to values measured initially<br><br>As specified in section "Insulation resistance" of this specification                                                                                     |
| <b>SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B</b> |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11 Climatic sequence                                                     |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11.1 Initial measurements                                                | Capacitance<br>Measured in 4.4.2 and 4.9.2<br>Tangent of loss angle:<br>Measured initially in C1A and C1B                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11.2 Dry heat                                                            | Temperature: 110 °C                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11.3 Damp heat cyclic<br>Test Db<br>First cycle                          | Duration: 16 h                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11.4 Cold                                                                | Temperature: - 55 °C                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11.5 Damp heat cyclic<br>Test Db<br>remaining cycles                     | Duration: 2 h                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.11.6 Final measurements                                                  | Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Voltage proof<br>1350 V <sub>DC</sub> ; 1 min between terminations<br><br>Insulation resistance | No visible damage<br>Legible marking<br><br>$ \Delta C/C  \leq 5\%$ of the value measured in 4.11.1.<br><br>Increase of $\tan \delta$ :<br>$\leq 0.008$ for: $C \leq 1\ \mu\text{F}$ or<br>$\leq 0.005$ for: $C > 1\ \mu\text{F}$<br>Compared to values measured in 4.11.1.<br><br>No permanent breakdown or flash-over<br><br>$\geq 50\%$ of values specified in section "Insulation resistance" of this specification |
| <b>SUB GROUP C2</b>                                                        |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.12 Damp heat steady state                                                | 56 days, 40 °C, 90 % to 95 % RH<br>No load                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.12.1 Initial measurements                                                | Capacitance<br>Tangent of loss angle at 1 kHz                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                         |



| <b>GROUP C INSPECTION REQUIREMENTS</b> |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SUB-CLAUSE NUMBER AND TEST</b>      | <b>CONDITIONS</b>                                                                                                                                                                                                                          | <b>PERFORMANCE REQUIREMENTS</b>                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>SUB GROUP C2</b>                    |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4.12.3 Final measurements              | Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Voltage proof<br>1350 V <sub>DC</sub> ; 1 min between terminations<br><br>Insulation resistance                                                                  | No visible damage<br>Legible marking<br><br>$ \Delta C/C  \leq 5\%$ of the value measured in 4.12.1.<br><br>Increase of $\tan \delta$ :<br>$\leq 0.008$ for: $C \leq 1\ \mu\text{F}$ or<br>$\leq 0.005$ for: $C > 1\ \mu\text{F}$<br>Compared to values measured in 4.12.1.<br><br>No permanent breakdown or flash-over<br><br>$\geq 50\%$ of values specified in section "Insulation resistance" of this specification        |
| <b>SUB-GROUP C3</b>                    |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4.13.1 Initial measurements            | Capacitance<br>Tangent of loss angle:<br>For $C \leq 1\ \mu\text{F}$ at 10 kHz<br>For $C > 1\ \mu\text{F}$ at 1 kHz                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4.13 Impulse voltage                   | 3 successive impulses, full wave, peak voltage:<br>2.5 kV for $C \leq 1\ \mu\text{F}$<br>2.5 kV/ $\sqrt{C}$ for $C > 1\ \mu\text{F}$<br>Max. 24 pulses                                                                                     | No selfhealing breakdowns or flashover                                                                                                                                                                                                                                                                                                                                                                                         |
| 4.14 Endurance                         | Duration: 1000 h<br>1.25 x U <sub>RAC</sub> at 110 °C<br>Once in every hour the voltage is increased to<br>1000 V <sub>RMS</sub> for 0.1 s via resistor of $47\ \Omega \pm 5\%$                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4.14.7 Final measurements              | Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Voltage proof<br>1350 V <sub>DC</sub> ; 1 min between terminations<br>2120 V <sub>AC</sub> ; 1 min between terminations<br>and case<br><br>Insulation resistance | No visible damage<br>Legible marking<br><br>$ \Delta C/C  \leq 10\%$ compared to values measured in 4.13.1.<br><br>Increase of $\tan \delta$ :<br>$\leq 0.008$ for: $C \leq 1\ \mu\text{F}$ or<br>$\leq 0.005$ for: $C > 1\ \mu\text{F}$<br>Compared to values measured in 4.13.1.<br><br>No permanent breakdown or flash-over<br><br>$\geq 50\%$ of values specified in section "Insulation resistance" of this specification |
| <b>SUB-GROUP C4</b>                    |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4.15 Charge and discharge              | 10 000 cycles<br>Charged to 435 V <sub>DC</sub><br>Discharge resistance:<br>$R = \frac{435\ V_{DC}}{1.25 \times C\ (dU/dt)}$                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                |



| <b>GROUP C INSPECTION REQUIREMENTS</b> |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SUB-CLAUSE NUMBER AND TEST</b>      | <b>CONDITIONS</b>                                                                                                                                                                                                                                                                                                                                  | <b>PERFORMANCE REQUIREMENTS</b>                                                                                                                                                                                                                                                                                                      |
| <b>SUB-GROUP C4</b>                    |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                      |
| 4.15.1 Initial measurements            | Capacitance<br>Tangent of loss angle:<br>For $C \leq 1 \mu\text{F}$ at 10 kHz<br>For $C > 1 \mu\text{F}$ at 1 kHz                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                      |
| 4.15.3 Final measurements              | Capacitance<br><br>Tangent of loss angle<br><br>Insulation resistance                                                                                                                                                                                                                                                                              | $ \Delta C/C  \leq 10\%$ compared to values measured in 4.15.1.<br><br>Increase of $\tan \delta$ :<br>$\leq 0.008$ for: $C \leq 1 \mu\text{F}$ or<br>$\leq 0.005$ for: $C > 1 \mu\text{F}$<br>Compared to values measured in 4.15.1.<br><br>$\geq 50\%$ of values specified in section "Insulation resistance" of this specification |
| <b>SUB-GROUP C5</b>                    |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                      |
| 4.16 Radio frequency characteristic    | Resonance frequency                                                                                                                                                                                                                                                                                                                                | $\geq 0.9$ times the value as specified in section "Resonant frequency" of this specification                                                                                                                                                                                                                                        |
| <b>SUB-GROUP C6</b>                    |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                      |
| 4.17 Passive flammability<br>Class B   | Bore of gas jet: $\varnothing 0.5 \text{ mm}$<br>Fuel: Butane<br>Test duration for actual volume $V$ in $\text{mm}^3$ :<br>$V \leq 250$ : 10 s<br>$250 < V \leq 500$ : 20 s<br>$500 < V \leq 1750$ : 30 s<br>$V > 1750$ : 60 s<br>One flame application<br><br> | After removing test flame from capacitor, the capacitor must not continue to burn for more than 10 s. No burning particle must drop from the sample.                                                                                                                                                                                 |
| <b>SUB-GROUP C7</b>                    |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                      |
| 4.18 Active flammability               | 20 cycles of 2.5 kV discharges on the test capacitor connected to $U_{\text{RAC}}$ .                                                                                                                                                                                                                                                               | The cheese cloth around the capacitors shall not burn with a flame.<br>No electrical measurements are required.                                                                                                                                                                                                                      |



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