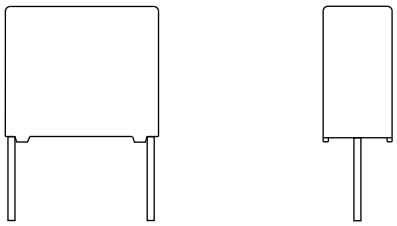
# THE DATASHEET OF

# BFC233922105

# Interference Suppression Film Capacitors
# MKP Radial Potted Type



## FEATURES

- AEC-Q200 qualified (rev. C)
- THB: 40 °C / 93 % RH for 1000 h at rated voltage, in compliance with AEC-Q200
- Compliant with IEC 60381-14: AMD1 grade IA
- High temperature capabilities, up to 125 °C
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

## APPLICATIONS

For standard across the line X2 applications.

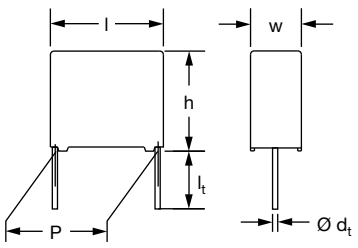
See also application note: www.vishay.com/doc?28153

| QUICK REFERENCE DATA | |
|---|---|
| Rated capacitance range (E12 series) | 0.001 µF to 4.7 µF (preferred values acc. to E6) |
| Capacitance tolerance | ± 20 %; ± 10 %; ± 5 % |
| Rated voltage range, $U_{RAC}$ | 310 $V_{AC}$; 50 Hz to 60 Hz |
| Permissible DC voltage | 800 $V_{DC}$ at 85 °C<br>630 $V_{DC}$ at 110 °C |
| Climatic testing class | 55/110/56/C for product volumes ≤ 1750 mm$^3$<br>55/110/56/B for product volumes > 1750 mm$^3$ |
| Rated temperature | 110 °C |
| Maximum application temperature | 125 °C for limited time |
| Reference standards | IEC 60384-14:2013<br>IEC 60384-14:2013 / AMD1:2016<br>EN 60384-14:2013 + AMD1:2016<br>IEC 60065 requires pass. flamm. class B for volumes > 1750 mm$^3$<br>UL 60384-14<br>CSA-E384-14<br>CQC |
| Dielectric | Polypropylene film |
| Electrodes | Metallized |
| Construction | Mono construction |
| 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;<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

## DIMENSIONS in millimeters



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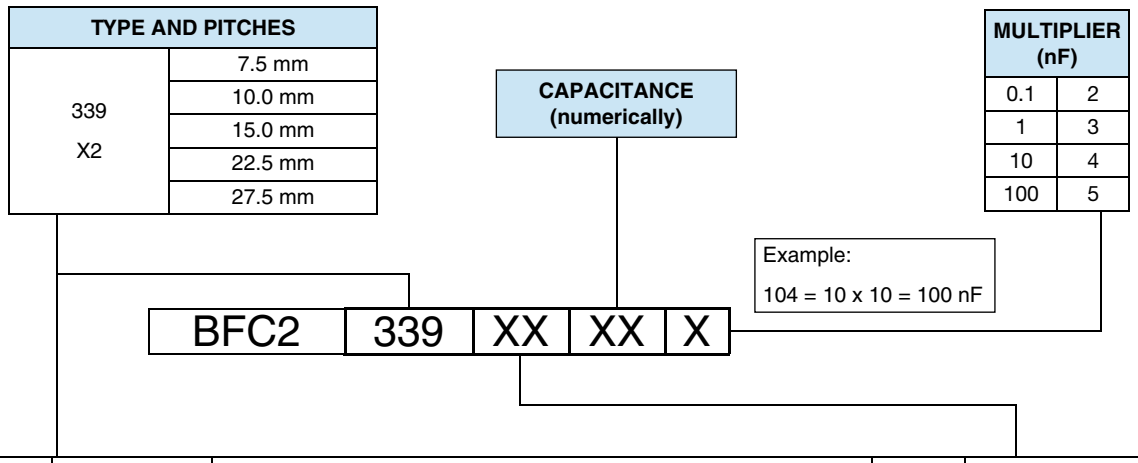
## COMPOSITION OF CATALOG NUMBER




| TYPE | PACKAGING | STANDARD DIMENSIONS | C-TOL. | CODE NUMBER |
|---|---|---|---|---|
| 339 X2 | Loose in box | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 20 % | BFC2 339 20... |
| | | Lead length 5.0 mm ± 1.0 mm | | BFC2 339 22... |
| | | Lead length 25.0 mm ± 2.0 mm | | BFC2 339 24... |
| | Taped (1) | Reel: H = 18.5 mm; $P_0$ = 12.7 mm or 15.0 mm | | BFC2 339 26... |
| | | Ammopack: H = 18.5 mm; $P_0$ = 12.7 mm | | BFC2 339 28... |
| | Loose in box | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 10 % | BFC2 339 10... |
| | | Lead length 5.0 mm ± 1.0 mm | | BFC2 339 12... |
| | | Lead length 25.0 mm ± 2.0 mm | | BFC2 339 14... |
| | Taped (1) | Reel: H = 18.5 mm; $P_0$ = 12.7 mm or 15.0 mm | | BFC2 339 16... |
| | | Ammopack: H = 18.5 mm; $P_0$ = 12.7 mm | | BFC2 339 18... |
| | Loose in box | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 5 % | BFC2 339 50... |
| | | Lead length 5.0 mm ± 1.0 mm | | BFC2 339 52... |
| | | Llead length 25.0 mm ± 2.0 mm | | BFC2 339 54... |
| | Taped (1) | Reel: H = 18.5 mm; $P_0$ = 12.7 mm or 15.0 mm | | BFC2 339 36... |
| | | Ammopack: H = 18.5 mm; $P_0$ = 12.7 mm | | BFC2 339 38... |
| | **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 % | BFC2 339 21... |
| | | Lead length 5.0 mm ± 1.0 mm | | BFC2 339 23... |
| | | Lead length 25.0 mm ± 2.0 mm | | BFC2 339 25... |
| | Taped (1)(2) | Reel or ammopack: H = 18.5 mm; $P_0$ = 12.7 mm | | BFC2 339 27... |
| | Loose in box | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 10 % | BFC2 339 11... |
| | | Lead length 5.0 mm ± 1.0 mm | | BFC2 339 13... |
| | | Lead length 25.0 mm ± 2.0 mm | | BFC2 339 15... |
| | Taped (1)(2) | Reel or ammopack: H = 18.5 mm; $P_0$ = 12.7 mm | | BFC2 339 17... |
| | Loose in box | Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm | ± 5 % | BFC2 339 51... |
| | | Lead length 5.0 mm ± 1.0 mm | | BFC2 339 53... |
| | | Lead length 25.0 mm ± 2.0 mm | | BFC2 339 55... |
| | Taped (1)(2) | Reel: H = 18.5 mm; $P_0$ = 12.7 mm or 15.0 mm | | BFC2 339 46... |
| | | Ammopack: H = 18.5 mm; $P_0$ = 12.7 mm | | BFC2 339 48... |

**Notes**

(1) For detailed tape specification refer to “Packaging Information”: www.vishay.com/doc?28139

(2) Taped on reel pitch = 27.5 mm is not available



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| 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 nF | ≤ 10 x $10^{-4}$ | ≤ 20 x $10^{-4}$ |
| 470 nF ≤ C ≤ 1 µF | ≤ 20 x $10^{-4}$ | ≤ 70 x $10^{-4}$ |
| C > 1 µF | ≤ 30 x $10^{-4}$ | - |
| Rated voltage pulse slope $(dU/dt)_R$ at 435 $V_{DC}$: | | |
| Pitch = 7.5 mm | 600 V/µs | |
| Pitch = 10 mm | 600 V/µs | |
| Pitch = 15 mm | 400 V/µs | |
| Pitch = 22.5 mm | 150 V/µs | |
| Pitch = 27.5 mm | 100 V/µs | |
| R between leads, for C ≤ 0.33 µF at 100 V; 1 min | > 15 000 MΩ | |
| RC between leads, for C > 0.33 µF at 100 V; 1 min | > 5000 s | |
| R between leads and case; 100 V; 1 min | > 30 000 MΩ | |
| Withstanding (DC) voltage (cut off current 10 mA) (1); rise time ≤ 1000 V/s: | | |
| C ≤ 1 µF | 2200 V; 1 min | |
| C > 1 µF | 1800 V; 1 min | |
| Withstanding (AC) voltage between leads and case | 2120 V; 1 min | |
| Max. application temperature for 0.001 µF ≤ C ≤ 0.47 µF | 125 °C up to 1000 h | |
| Max. application temperature for C > 0.47 µF | 125 °C up to 500 h | |

**Note**

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

**ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 7.5 mm**

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) (2) | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | AMMOPACK (1) | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | |
| | | | | $l_t$ = 3.5 mm + 1 mm/- 0.5 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ |
| | PITCH = 7.5 mm ± 0.4 mm; $d_t$ = 0.50 mm ± 0.05 mm; C-TOL. = ± 20 % | | | | | | | | | |
| 310 | 0.0010 | 4.0 x 9.0 x 10.0 | 0.4 | 20102 | 22102 | 1500 | 24102 | 1000 | 28102 | 1250 |
| | 0.0015 | | | 20152 | 22152 | | 24152 | | 28152 | |
| | 0.0022 | | | 20222 | 22222 | | 24222 | | 28222 | |
| | 0.0033 | | | 20332 | 22332 | | 24332 | | 28332 | |
| | 0.0047 | | | 20472 | 22472 | | 24472 | | 28472 | |
| | 0.0068 | | | 20682 | 22682 | | 24682 | | 28682 | |
| | 0.010 | | | 20103 | 22103 | | 24103 | | 28103 | |
| | 0.015 | | | 20153 | 22153 | | 24153 | | 28153 | |
| | 0.022 | | | 20223 | 22223 | | 24223 | | 28223 | |
| | 0.033 | | | 20333 | 22333 | | 24333 | | 28333 | |
| | 0.047 | 5.0 x 10.5 x 10.0 | 0.4 | 20473 | 22473 | 1000 | 24473 | 1250 | 28473 | 1000 |
| | 0.068 | 6.0 x 11.5 x 10.0 | 0.8 | 20683 | 22683 | 750 | 24683 | 1000 | 28683 | 750 |


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## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 7.5 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) [2] | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | AMMOPACK [1] | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | |
| | | | | $l_t$ = 3.5 mm + 1 mm/- 0.5 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ |
| 310 | PITCH = 7.5 mm ± 0.4 mm; $d_t$ = 0.50 mm ± 0.05 mm; C-TOL. = ± 10 % | | | | | | | | | |
| | 0.0010 | 4.0 x 9.0 x 10.0 | 0.45 | 10102 | 12102 | 1500 | 14102 | 1000 | 18102 | 1250 |
| | 0.0012 | | | 10122 | 12122 | | 14122 | | 18122 | |
| | 0.0015 | | | 10152 | 12152 | | 14152 | | 18152 | |
| | 0.0018 | | | 10182 | 12182 | | 14182 | | 18182 | |
| | 0.0022 | | | 10222 | 12222 | | 14222 | | 18222 | |
| | 0.0027 | | | 10272 | 12272 | | 14272 | | 18272 | |
| | 0.0033 | | | 10332 | 12332 | | 14332 | | 18332 | |
| | 0.0039 | | | 10392 | 12392 | | 14392 | | 18392 | |
| | 0.0047 | | | 10472 | 12472 | | 14472 | | 18472 | |
| | 0.0056 | | | 10562 | 12562 | | 14562 | | 18562 | |
| | 0.0068 | | | 10682 | 12682 | | 14682 | | 18682 | |
| | 0.0082 | | | 10822 | 12822 | | 14822 | | 18822 | |
| | 0.010 | | | 10103 | 12103 | | 14103 | | 18103 | |
| | 0.012 | | | 10123 | 12123 | | 14123 | | 18123 | |
| | 0.015 | | | 10153 | 12153 | | 14153 | | 18153 | |
| | 0.018 | | | 10183 | 12183 | | 14183 | | 18183 | |
| | 0.022 | | | 10223 | 12223 | | 14223 | | 18223 | |
| | 0.027 | | | 10273 | 12273 | | 14273 | | 18273 | |
| | 0.033 | 5.0 x 10.5 x 10.0 | 0.6 | 10333 | 12333 | 1000 | 14333 | 1250 | 18333 | 1000 |
| | 0.039 | | | 10393 | 12393 | | 14393 | | 18393 | |
| | 0.047 | | | 10473 | 12473 | | 14473 | | 18473 | |
| | 0.056 | 6.0 x 11.5 x 10.0 | 0.8 | 10563 | 12563 | 750 | 14563 | 1000 | 18563 | 750 |
| | PITCH = 7.5 mm ± 0.4 mm; $d_t$ = 0.50 mm ± 0.05 mm; C-TOL. = ± 5 % | | | | | | | | | |
| | 0.0010 | 4.0 x 9.0 x 10.0 | 0.45 | 50102 | 52102 | 1500 | 54102 | 1000 | 38102 | 1250 |
| | 0.0012 | | | 50122 | 52122 | | 54122 | | 38122 | |
| | 0.0015 | | | 50152 | 52152 | | 54152 | | 38152 | |
| | 0.0018 | | | 50182 | 52182 | | 54182 | | 38182 | |
| | 0.0022 | | | 50222 | 52222 | | 54222 | | 38222 | |
| | 0.0027 | | | 50272 | 52272 | | 54272 | | 38272 | |
| | 0.0033 | | | 50332 | 52332 | | 54332 | | 38332 | |
| | 0.0039 | | | 50392 | 52392 | | 54392 | | 38392 | |
| | 0.0047 | | | 50472 | 52472 | | 54472 | | 38472 | |
| | 0.0056 | | | 50562 | 52562 | | 54562 | | 38562 | |
| | 0.0068 | | | 50682 | 52682 | | 54682 | | 38682 | |
| | 0.0082 | | | 50822 | 52822 | | 54822 | | 38822 | |
| | 0.010 | | | 50103 | 52103 | | 54103 | | 38103 | |
| | 0.012 | | | 50123 | 52123 | | 54123 | | 38123 | |
| | 0.015 | | | 50153 | 52153 | | 54153 | | 38153 | |
| | 0.018 | | | 50183 | 52183 | | 54183 | | 38183 | |
| | 0.022 | | | 50223 | 52223 | | 54223 | | 38223 | |
| | 0.027 | | | 50273 | 52273 | | 54273 | | 38273 | |
| | 0.033 | 5.0 x 10.5 x 10.0 | 0.6 | 50333 | 52333 | 1000 | 54333 | 1250 | 38333 | 1000 |
| | 0.039 | | | 50393 | 52393 | | 54393 | | 38393 | |
| | 0.047 | 6.0 x 11.5 x 10.0 | 0.8 | 50473 | 52473 | 750 | 54473 | 1000 | 38473 | 750 |
| | 0.056 | | | 50563 | 52563 | | 54563 | | 38563 | |

**Notes**

- SPQ = Standard Packing Quantity

[1] H = in-tape height; $P_0$ = sprocket hole distance; for detailed specifications refer to packaging information

[2] Weight for short lead product only



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## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 10 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) [3] | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | AMMOPACK [1] | | LARGE REEL (500 mm) [1][2] | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | | H = 18.5.mm $P_0$ = 15.0 mm | |
| | | | | $l_t$ = 3.5 mm + 1 mm/- 0.5 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ | | SPQ |
| 310 | PITCH = 10.0 mm ± 0.4 mm; $d_t$ = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 % | | | | | | | | | | | |
| | 0.0010 | 4.0 x 10.0 x 12.5 | 0.6 | 21102 | 23102 | 1000 | 25102 | 1250 | 27102 | 950 | - | - |
| | 0.0015 | | | 21152 | 23152 | | 25152 | | 27152 | | | |
| | 0.0022 | | | 21222 | 23222 | | 25222 | | 27222 | | | |
| | 0.0033 | | | 21332 | 23332 | | 25332 | | 27332 | | | |
| | 0.0047 | | | 21472 | 23472 | | 25472 | | 27472 | | | |
| | 0.0068 | | | 21682 | 23682 | | 25682 | | 27682 | | | |
| | 0.010 | | | 21103 | 23103 | | 25103 | | 27103 | | | |
| | 0.015 | | | 21153 | 23153 | | 25153 | | 27153 | | | |
| | 0.022 | | | 21223 | 23223 | | 25223 | | 27223 | | | |
| | 0.033 | | | 21333 | 23333 | | 25333 | | 27333 | | | |
| | 0.047 | | | 21473 | 23473 | | 25473 | | 27473 | | | |
| | 0.068 | 5.0 x 11.0 x 12.5 | 0.82 | 21683 | 23683 | 1000 | 25683 | 1000 | 27683 | 750 | - | - |
| | 0.100 | 6.0 x 12.0 x 12.5 | 1.1 | 20104 | 22104 | 750 | 24104 | 750 | 28104 | 600 | 26104 | 1500 |
| | PITCH = 10.0 mm ± 0.4 mm; $d_t$ = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 % | | | | | | | | | | | |
| | 0.0010 | 4.0 x 10.0 x 12.5 | 0.6 | 11102 | 13102 | 1000 | 15102 | 1250 | 17102 | 950 | - | - |
| | 0.0012 | | | 11122 | 13122 | | 15122 | | 17122 | | | |
| | 0.0015 | | | 11152 | 13152 | | 15152 | | 17152 | | | |
| | 0.0018 | | | 11182 | 13182 | | 15182 | | 17182 | | | |
| | 0.0022 | | | 11222 | 13222 | | 15222 | | 17222 | | | |
| | 0.0027 | | | 11272 | 13272 | | 15272 | | 17272 | | | |
| | 0.0033 | | | 11332 | 13332 | | 15332 | | 17332 | | | |
| | 0.0039 | | | 11392 | 13392 | | 15392 | | 17392 | | | |
| | 0.0047 | | | 11472 | 13472 | | 15472 | | 17472 | | | |
| | 0.0056 | | | 11562 | 13562 | | 15562 | | 17562 | | | |
| | 0.0068 | | | 11682 | 13682 | | 15682 | | 17682 | | | |
| | 0.0082 | | | 11822 | 13822 | | 15822 | | 17822 | | | |
| | 0.010 | | | 11103 | 13103 | | 15103 | | 17103 | | | |
| | 0.012 | | | 11123 | 13123 | | 15123 | | 17123 | | | |
| | 0.015 | | | 11153 | 13153 | | 15153 | | 17153 | | | |
| | 0.018 | | | 11183 | 13183 | | 15183 | | 17183 | | | |
| | 0.022 | | | 11223 | 13223 | | 15223 | | 17223 | | | |
| | 0.027 | | | 11273 | 13273 | | 15273 | | 17273 | | | |
| | 0.033 | | | 11333 | 13333 | | 15333 | | 17333 | | | |
| | 0.039 | | | 11393 | 13393 | | 15393 | | 17393 | | | |
| | 0.047 | | | 11473 | 13473 | | 15473 | | 17473 | | | |
| | 0.056 | 5.0 x 11.0 x 12.5 | 0.82 | 11563 | 13563 | 1000 | 15563 | 1000 | 17563 | 750 | - | - |
| | 0.068 | | | 10683 | 12683 | | 14683 | | 18683 | | 16683 | 1900 |
| | 0.082 | 6.0 x 12.0 x 12.5 | 1.1 | 10823 | 12823 | 750 | 14823 | 750 | 18823 | 600 | 16823 | 1500 |
| | 0.100 | | | 10104 | 12104 | | 14104 | | 18104 | | 16104 | |


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## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 10 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) (3) | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | AMMOPACK (1) | | LARGE REEL (500 mm) (1)(2) | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | | H = 18.5.mm $P_0$ = 15.0 mm | |
| | | | | $l_t$ = 3.5 mm + 1 mm/- 0.5 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ | | SPQ |
| | PITCH = 10.0 mm ± 0.4 mm; $d_t$ = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 % | | | | | | | | | | | |
| | 0.0010 | | | 51102 | 53102 | | 55102 | | 48102 | | | |
| | 0.0012 | | | 51122 | 53122 | | 55122 | | 48122 | | | |
| | 0.0015 | | | 51152 | 53152 | | 55152 | | 48152 | | | |
| | 0.0018 | | | 51182 | 53182 | | 55182 | | 48182 | | | |
| | 0.0022 | | | 51222 | 53222 | | 55222 | | 48222 | | | |
| | 0.0027 | | | 51272 | 53272 | | 55272 | | 48272 | | | |
| | 0.0033 | | | 51332 | 53332 | | 55332 | | 48332 | | | |
| | 0.0039 | | | 51392 | 53392 | | 55392 | | 48392 | | | |
| | 0.0047 | | | 51472 | 53472 | | 55472 | | 48472 | | | |
| | 0.0056 | | | 51562 | 53562 | | 55562 | | 48562 | | | |
| | 0.0068 | 4.0 x 10.0 x 12.5 | 0.6 | 51682 | 53682 | 1000 | 55682 | 1250 | 48682 | 950 | - | - |
| 310 | 0.0082 | | | 51822 | 53822 | | 55822 | | 48822 | | | |
| | 0.010 | | | 51103 | 53103 | | 55103 | | 48103 | | | |
| | 0.012 | | | 51123 | 53123 | | 55123 | | 48123 | | | |
| | 0.015 | | | 51153 | 53153 | | 55153 | | 48153 | | | |
| | 0.018 | | | 51183 | 53183 | | 55183 | | 48183 | | | |
| | 0.022 | | | 51223 | 53223 | | 55223 | | 48223 | | | |
| | 0.027 | | | 51273 | 53273 | | 55273 | | 48273 | | | |
| | 0.033 | | | 51333 | 53333 | | 55333 | | 48333 | | | |
| | 0.039 | | | 51393 | 53393 | | 55393 | | 48393 | | | |
| | 0.047 | | | 51473 | 53473 | | 55473 | | 48473 | | | |
| | 0.056 | 5.0 x 11.0 x 12.5 | 0.82 | 51563 | 53563 | 1000 | 55563 | 1000 | 48563 | 750 | 46563 | 1900 |
| | 0.068 | | | 50683 | 52683 | | 54683 | | 38683 | | 36683 | |
| | 0.082 | 6.0 x 12.0 x 12.5 | 1.1 | 50823 | 52823 | 750 | 54823 | 750 | 38823 | 600 | 36823 | 1500 |

**Notes**

- SPQ = Standard Packing Quantity

(1) H = in-tape height; $P_0$ = sprocket hole distance; for detailed specifications refer to packaging information

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

(3) Weight for short lead product only



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## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 15 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) [3] | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | LARGE REEL (500 mm) [1][2] | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | |
| | | | | $l_t$ = 3.5 mm ± 0.3 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ |
| 310 | **PITCH = 15 mm ± 0.4 mm; $d_t$ = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %** | | | | | | | | | |
| | 0.010 | 5.0 x 11.0 x 17.5 | 1 | 90001 | 90007 | 1250 | 90014 | 1000 | 90021 | 1100 |
| | 0.015 | | | 90002 | 90008 | | 90015 | | 90022 | |
| | 0.022 | | | 90003 | 90009 | | 90016 | | 90023 | |
| | 0.033 | | | 90004 | 90011 | | 90017 | | 90024 | |
| | 0.047 | | | 90005 | 90012 | | 90018 | | 90025 | |
| | 0.068 | | | 90006 | 90013 | | 90019 | | 90026 | |
| | 0.10 | | | 21104 | 23104 | | 25104 | | 27104 | |
| | 0.15 | 6.0 x 12.0 x 17.5 | 1.4 | 20154 | 22154 | 1000 | 24154 | 1000 | 26154 | 900 |
| | **PITCH = 15 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %** | | | | | | | | | |
| | 0.22 | 7.0 x 13.5 x 17.5 | 1.8 | 20224 | 22224 | 750 | 24224 | 500 | 26224 | 800 |
| | 0.33 | 8.5 x 15.0 x 17.5 | 2.4 | 20334 | 22334 | 750 | 24334 | 500 | 26334 | 650 |
| | 0.47 | 10.0 x 16.5 x 17.5 | 3.0 | 20474 | 22474 | 500 | 24474 | 450 | 26474 | 600 |
| | | 8.5 x 17.5 x 18.0 | 3.1 | 90165 | 90166 | 300 | 90143 | 500 | - | - |
| | 0.56 | 11.0 x 18.5 x 18.0 | 4.3 | 90174 | 90175 | 225 | 90176 | 350 | - | - |
| | 0.68 | 11.0 x 18.5 x 18.0 | 5.5 | 90168 | 90169 | 225 | 90145 | 350 | - | - |
| | **PITCH = 15 mm ± 0.4 mm; $d_t$ = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %** | | | | | | | | | |
| | 0.010 | 5.0 x 11.0 x 17.5 | 1.0 | 90027 | 90039 | 1250 | 90052 | 1000 | 90064 | 1100 |
| | 0.012 | | | 90028 | 90041 | | 90053 | | 90065 | |
| | 0.015 | | | 90029 | 90042 | | 90054 | | 90066 | |
| | 0.018 | | | 90031 | 90043 | | 90055 | | 90067 | |
| | 0.022 | | | 90032 | 90044 | | 90056 | | 90068 | |
| | 0.027 | | | 90033 | 90045 | | 90057 | | 90069 | |
| | 0.033 | | | 90034 | 90046 | | 90058 | | 90071 | |
| | 0.039 | | | 90035 | 90047 | | 90059 | | 90072 | |
| | 0.047 | | | 90036 | 90048 | | 90061 | | 90073 | |
| | 0.056 | | | 90037 | 90049 | | 90062 | | 90074 | |
| | 0.068 | | | 11683 | 13683 | | 15683 | | 17683 | |
| | 0.082 | | | 11823 | 13823 | | 15823 | | 17823 | |
| | 0.100 | | | 11104 | 13104 | | 15104 | | 17104 | |
| | 0.12 | 6.0 x 12.0 x 17.5 | 1.4 | 10124 | 12124 | 1000 | 14124 | 1000 | 16124 | 900 |
| | 0.15 | | | 10154 | 12154 | | 14154 | | 16154 | |
| | **PITCH = 15 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %** | | | | | | | | | |
| | 0.18 | 7.0 x 13.5 x 17.5 | 1.8 | 10184 | 12184 | 750 | 14184 | 500 | 16184 | 800 |
| | 0.22 | | | 10224 | 12224 | | 14224 | | 16224 | |
| | 0.27 | 8.5 x 15.0 x 17.5 | 2.4 | 10274 | 12274 | 750 | 14274 | 500 | 16274 | 650 |
| | 0.33 | | | 10334 | 12334 | | 14334 | | 16334 | |
| | 0.39 | 10.0 x 16.5 x 17.5 | 3.0 | 10394 | 12394 | 500 | 14394 | 450 | 16394 | 600 |
| | 0.47 | | | 10474 | 12474 | | 14474 | | 16474 | |
| | 0.56 | 11.0 x 18.5 x 18.0 | 4.3 | 90167 | 90157 | 225 | 90144 | 400 | - | - |


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## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 15 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) [3] | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | LARGE REEL (500 mm) [1][2] | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | |
| | | | | $l_t$ = 3.5 mm ± 0.3 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ |
| 310 | PITCH = 15 mm ± 0.4 mm; $d_t$ = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 % | | | | | | | | | |
| | 0.010 | 5.0 x 11.0 x 17.5 | 1.0 | 90221 | 90232 | 1250 | 90243 | 1000 | 90254 | 1100 |
| | 0.012 | | | 90222 | 90233 | | 90244 | | 90255 | |
| | 0.015 | | | 90223 | 90234 | | 90245 | | 90256 | |
| | 0.018 | | | 90224 | 90235 | | 90246 | | 90257 | |
| | 0.022 | | | 90225 | 90236 | | 90247 | | 90258 | |
| | 0.027 | | | 90226 | 90237 | | 90248 | | 90259 | |
| | 0.033 | | | 90227 | 90238 | | 90249 | | 90261 | |
| | 0.039 | | | 90228 | 90239 | | 90251 | | 90262 | |
| | 0.047 | | | 90229 | 90241 | | 90252 | | 90263 | |
| | 0.056 | | | 90231 | 90242 | | 90253 | | 90264 | |
| | 0.068 | | | 51683 | 53683 | | 55683 | | 46683 | |
| | 0.082 | | | 51823 | 53823 | | 55823 | | 46823 | |
| | 0.10 | | | 50104 | 52104 | | 54104 | | 36104 | |
| | 0.12 | 6.0 x 12.0 x 17.5 | 1.4 | 50124 | 52124 | 1000 | 54124 | 1000 | 36124 | 900 |
| | 0.15 | | | 50154 | 52154 | | 54154 | | 36154 | |
| | PITCH = 15 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 % | | | | | | | | | |
| | 0.18 | 7.0 x 13.5 x 17.5 | 1.8 | 50184 | 52184 | 750 | 54184 | 500 | 36184 | 800 |
| | 0.22 | 8.5 x 15.0 x 17.5 | 2.4 | 50224 | 52224 | 750 | 54224 | 500 | 36224 | 650 |
| | 0.27 | | | 50274 | 52274 | | 54274 | | 36274 | |
| | 0.33 | | | 50334 | 52334 | | 54334 | | 36334 | |
| | 0.39 | 10.0 x 16.5 x 17.5 | 3.0 | 50394 | 52394 | 500 | 54394 | 450 | 36394 | 600 |

**Notes**

- SPQ = Standard Packing Quantity

(1) H = in-tape height; $P_0$ = sprocket hole distance; for detailed specifications refer to packaging information

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

(3) Weight for short lead product only

## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 22.5 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) [3] | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | LARGE REEL (500 mm) [1][2] | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | |
| | | | | $l_t$ = 3.5 mm ± 0.3 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ |
| 310 | PITCH = 22.5 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 % | | | | | | | | | |
| | 0.15 | 6.0 x 15.5 x 26.0 | 2.4 | 21154 | 23154 | 300 | 25154 | 250 | 27154 | 600 |
| | 0.22 | | | 21224 | 23224 | | 25224 | | 27224 | |
| | 0.33 | | | 21334 | 23334 | | 25334 | | 27334 | |
| | 0.47 | 7.0 x 16.5 x 26.0 | 2.9 | 21474 | 23474 | 200 | 25474 | 250 | 27474 | 500 |
| | 0.68 | 8.5 x 18.0 x 26.0 | 3.8 | 20684 | 22684 | 200 | 24684 | 250 | 26684 | 450 |
| | 1.0 | 10.0 x 19.5 x 26.0 | 6.8 | 20105 | 22105 | 200 | 24105 | 200 | 26105 | 350 |
| | 1.5 | 12.5 x 22.5 x 26.5 | 10 | 90103 | 90138 | 140 | 90139 | 400 | 90141 | 300 |


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## ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 22.5 mm

| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) [3] | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LOOSE IN BOX | | | | | LARGE REEL (500 mm) [1][2] | |
| | | | | SHORT LEADS | | | LONG LEADS | | H = 18.5 mm $P_0$ = 12.7 mm | |
| | | | | $l_t$ = 3.5 mm ± 0.3 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ | | SPQ |
| 310 | PITCH = 22.5 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 % | | | | | | | | | |
| | 0.12 | 6.0 x 15.5 x 26.0 | 2.4 | 11124 | 13124 | 300 | 15124 | 250 | 17124 | 600 |
| | 0.15 | | | 11154 | 13154 | | 15154 | | 17154 | |
| | 0.18 | | | 11184 | 13184 | | 15184 | | 17184 | |
| | 0.22 | | | 11224 | 13224 | | 15224 | | 17224 | |
| | 0.27 | | | 11274 | 13274 | | 15274 | | 17274 | |
| | 0.33 | | | 11334 | 13334 | | 15334 | | 17334 | |
| | 0.33 | 8.5 x 14.0 x 26.5 | 3.6 | - | - | - | 75334 | 800 | - | - |
| | 0.39 | 7.0 x 16.5 x 26.0 | 2.9 | 11394 | 13394 | 200 | 15394 | 250 | 17394 | 500 |
| | 0.47 | | | 11474 | 13474 | | 15474 | | 17474 | |
| | 0.47 | 8.5 x 14.0 x 26.5 | 3.6 | - | - | - | 75474 | 800 | - | - |
| | 0.56 | 8.5 x 18.0 x 26.0 | 3.8 | 10564 | 12564 | 200 | 14564 | 250 | 16564 | 450 |
| | 0.68 | 10.0 x 19.5 x 26.0 | 6.8 | 10684 | 12684 | 200 | 14684 | 200 | 16684 | 350 |
| | 0.82 | | | 10824 | 12824 | | 14824 | | 16824 | |
| | 1.0 | 12.0 x 22.0 x 26.0 | 7.8 | 10105 | 12105 | 150 | 14105 | 200 | 16105 | 300 |
| | PITCH = 22.5 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 % | | | | | | | | | |
| | 0.12 | 6.0 x 15.5 x 26.0 | 2.4 | 51124 | 53124 | 300 | 55124 | 250 | 46124 | 600 |
| | 0.15 | | | 51154 | 53154 | | 55154 | | 46154 | |
| | 0.18 | | | 51184 | 53184 | | 55184 | | 46184 | |
| | 0.22 | | | 51224 | 53224 | | 55224 | | 46224 | |
| | 0.27 | | | 51274 | 53274 | | 55274 | | 46274 | |
| | 0.33 | 7.0 x 16.5 x 26.0 | 2.9 | 51334 | 53334 | 200 | 55334 | 250 | 46334 | 500 |
| | 0.39 | | | 51394 | 53394 | | 55394 | | 46394 | |
| | 0.47 | 8.5 x 18.0 x 26.0 | 3.8 | 51474 | 53474 | 200 | 55474 | 250 | 46474 | 450 |
| | 0.56 | | | 50564 | 52564 | | 54564 | | 36564 | |
| | 0.68 | 10.0 x 19.5 x 26.0 | 6.8 | 50684 | 52684 | 200 | 54684 | 200 | 36684 | 350 |
| | 0.82 | | | 50824 | 52824 | | 54824 | | 36824 | |
| | 1.0 | 12.0 x 22.0 x 26.0 | 7.8 | 50105 | 52105 | 150 | 54105 | 200 | 36105 | 300 |

**Notes**

- SPQ = Standard Packing Quantity

(1) H = in-tape height; $P_0$ = sprocket hole distance; for detailed specifications refer to packaging information

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

(3) Weight for short lead product only



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| ELECTRICAL DATA AND ORDERING INFORMATION - PITCH: 27.5 mm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $U_{RAC}$ (V) | CAP. (µF) | DIMENSIONS w x h x l (mm) | MASS (g) (1) | CATALOG NUMBER BFC2 339 XXXXX AND PACKAGING | | | | |
| | | | | LOOSE IN BOX | | | | |
| | | | | SHORT LEADS | | | LONG LEADS | |
| | | | | $l_t$ = 3.5 mm ± 0.3 mm | $l_t$ = 5.0 mm ± 1.0 mm | SPQ | $l_t$ = 25.0 mm ± 2.0 mm | SPQ |
| 310 | PITCH = 27.5 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 % | | | | | | | |
| | 0.47<br>0.68 | 9.0 x 19.0 x 31.5 | 5.5 | 90076<br>21684 | 90078<br>23684 | 100 | 90081<br>25684 | 150 |
| | 1.0 | 11.0 x 21.0 x 31.0 | 7.4 | 21105 | 23105 | 100 | 25105 | 125 |
| | 1.5 | 13.0 x 23.0 x 31.0 | 9.2 | 20155 | 22155 | 100 | 24155 | 125 |
| | 2.2 | 15.0 x 25.0 x 31.5 | 12.3 | 20225 | 22225 | 100 | 24225 | 125 |
| | 3.3 | 18.0 x 28.0 x 31.5 | 16.1 | 20335 | 22335 | 100 | 24335 | 100 |
| | 4.7 | 21.0 x 31.0 x 31.0 | 20.3 | 20475 | 22475 | 50 | 24475 | 75 |
| | PITCH = 27.5 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 % | | | | | | | |
| | 0.68 | 9.0 x 19.0 x 31.5 | 5.5 | 11684 | 13684 | 100 | 15684 | 150 |
| | 0.82<br>1.0<br>1.2 | 11.0 x 21.0 x 31.0 | 7.4 | 11824<br>11105<br>10125 | 13824<br>13105<br>12125 | 100 | 15824<br>15105<br>14125 | 125 |
| | 1.5 | 13.0 x 23.0 x 31.0 | 9.2 | 10155 | 12155 | 100 | 14155 | 125 |
| | 1.8<br>2.2 | 15.0 x 25.0 x 31.5 | 12.3 | 10185<br>10225 | 12185<br>12225 | 100 | 14185<br>14225 | 125 |
| | 2.7 | 18.0 x 28.0 x 31.5 | 16.1 | 10275 | 12275 | 100 | 14275 | 100 |
| | 3.3<br>3.9 | 21.0 x 31.0 x 31.0 | 20.3 | 10335<br>10395 | 12335<br>12395 | 50 | 14335<br>14395 | 75 |
| | PITCH = 27.5 mm ± 0.4 mm; $d_t$ = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 % | | | | | | | |
| | 0.68 | 9.0 x 19.0 x 31.5 | 5.5 | 51684 | 53684 | 100 | 55684 | 150 |
| | 0.82<br>1.0 | 11.0 x 21.0 x 31.0 | 7.4 | 51824<br>51105 | 53824<br>53105 | 100 | 55824<br>55105 | 125 |
| | 1.2<br>1.5 | 13.0 x 23.0 x 31.0 | 9.2 | 50125<br>50155 | 52125<br>52155 | 100 | 54125<br>54155 | 125 |
| | 1.8 | 15.0 x 25.0 x 31.5 | 12.3 | 50185 | 52185 | 100 | 54185 | 125 |
| | 2.2<br>2.7 | 18.0 x 28.0 x 31.5 | 16.1 | 50225<br>50275 | 52225<br>52275 | 100 | 54225<br>54275 | 100 |
| | 3.3 | 21.0 x 31.0 x 31.0 | 20.3 | 50335 | 52335 | 50 | 54335 | 75 |

**Notes**

- SPQ = Standard Packing Quantity

(1) Weight for short lead product only


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| APPROVALS | | | | |
|---|---|---|---|---|
| **SAFETY APPROVALS X2** | **VOLTAGE** | **VALUE** | **FILE NUMBERS** | **LINK** |
| EN 60384-14 (ENEC)<br>(= IEC 60384-14 ed-4 (2013)) | 310 $V_{AC}$ | 1 nF to 4.7 µF | ENEC16/FI/21/01054/A2 | www.vishay.com/doc?28179 |
| UL 60384-14 | 310 $V_{AC}$ | 1 nF to 4.7 µF | E354331 | www.vishay.com/doc?28184 |
| CSA-E384-14 | 310 $V_{AC}$ | 1 nF to 4.7 µF | E354331 | |
| CQC | 310 $V_{AC}$ | 1 nF to 4.7 µF | CQC 07001021281 (L) | www.vishay.com/doc?28180 |
| | | | CQC 06001018290 (F) | www.vishay.com/doc?28181 |
| CB test certificate | 310 $V_{AC}$ | 1 nF to 4.7 µF | FI-39827/A1 | www.vishay.com/doc?28175 |
| 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 bandoliers 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 or end of catalog.

### 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:

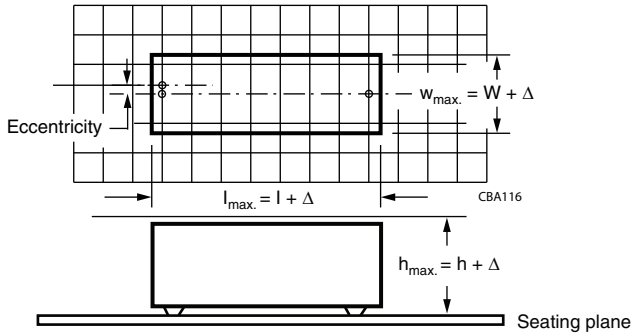
- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads.
- For larger pitches the capacitors shall be mounted in the same way and the body clamped.

### 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 ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm, $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 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

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

### Storage Temperature

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

### Ratings and Characteristics Reference Conditions

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

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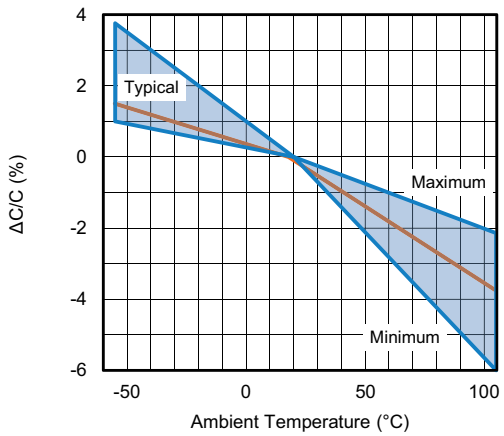
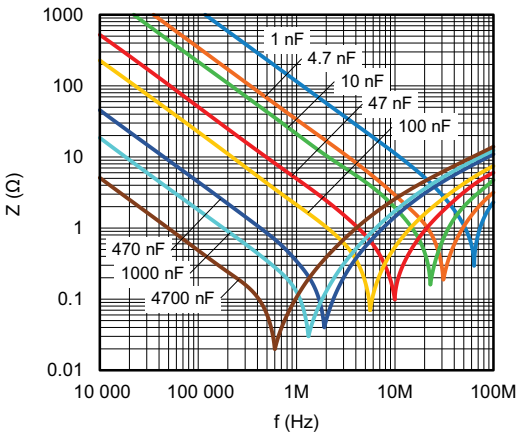
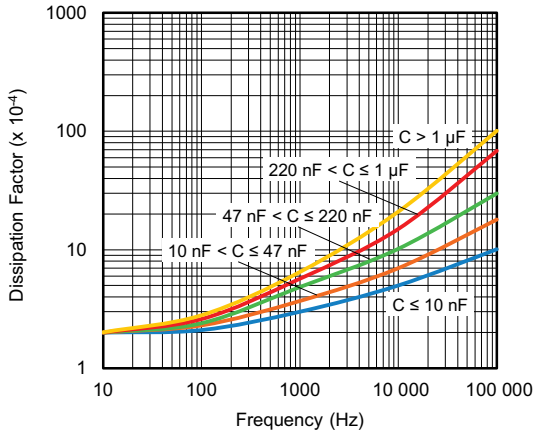
## CHARACTERISTICS



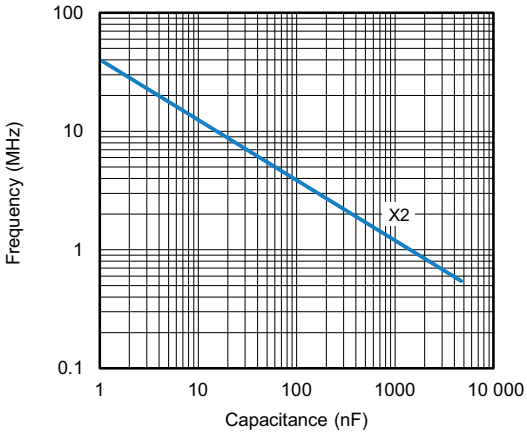

Capacitance as a function of ambient temperature (typical curve)



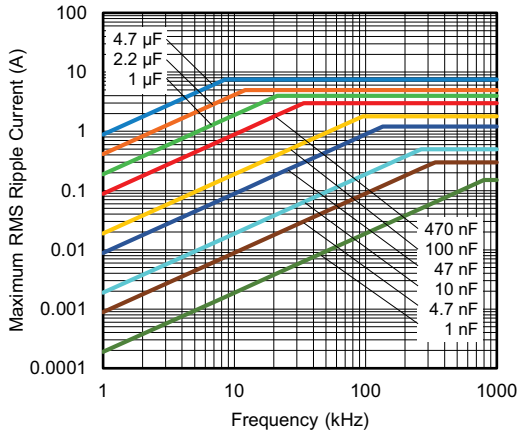

Impedance as a function of frequency (typical curve)



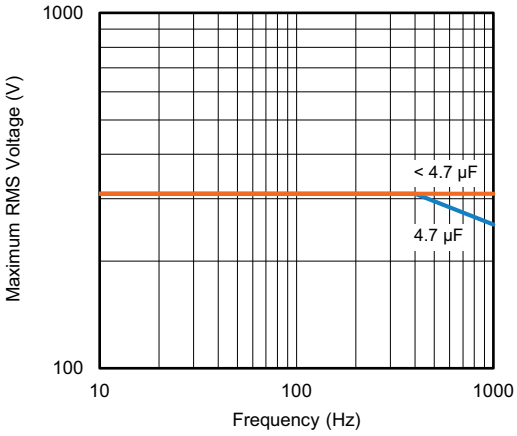

Tangent of loss angle as a function of frequency (typical curve)




Resonant frequency as a function of capacitance (typical curve)




Maximum RMS current as a function of frequency




Maximum RMS voltage as a function of frequency



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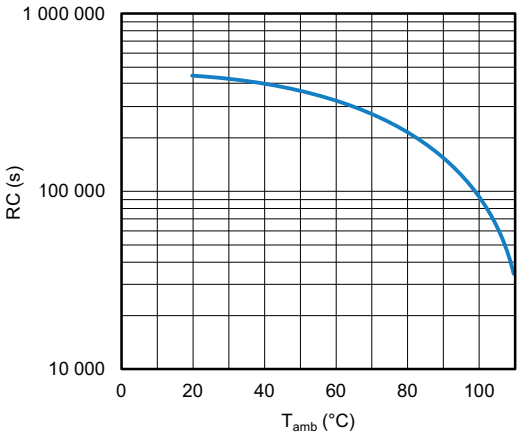


Insulation resistance as a function of ambient temperature (typical curve)

## APPLICATION NOTES

- For X2 electromagnetic interference suppression in **standard across the line applications** (50 Hz / 60 Hz) with a maximum mains voltage of 310 $V_{AC}$
- For series impedance applications we refer to application note 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
- These capacitors are not intended for continuous pulse application. 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 $V_{DC}$ and divided by the applied voltage

## INSPECTION REQUIREMENTS

### General Notes

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

| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1** | | |
| 4.1 Dimensions (detail) | | As specified in section “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 |


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| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1** | | |
| 4.4 Resistance to soldering heat | No pre-drying<br>Method: 1A<br>Solder bath: 280 °C ± 5 °C<br>Duration: 10 s | |
| 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 | No visible damage<br>Legible marking |
| | Capacitance | $\lvert\Delta C/C\rvert \leq 5$ % of the value measured initially. |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF<br>Compared to values measured initially |
| | Insulation resistance | As specified in section “Insulation Resistance” of this specification |
| **SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1** | | |
| Initial measurements | Capacitance<br>Tangent of loss angle:<br>For C ≤ 1 µF at 10 kHz<br>For C > 1 µF at 1 kHz | |
| 4.20 Solvent resistance of the marking | 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 | θA = -55 °C<br>θB = +110 °C<br>5 cycles<br>Duration t = 30 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 m/s²<br>(whichever is less severe)<br>Total duration 6 h | |
| 4.7.2 Final inspection | Visual examination | No visible damage |
| 4.9 Shock | Mounting: see section “Mounting” for more information<br>Pulse shape: half sine<br>Acceleration: 490 m/s²<br>Duration of pulse: 11 ms | |


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| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1** | | |
| 4.9.2 Final measurements | Visual examination | No visible damage |
| | Capacitance | $\|\Delta C/C\| \leq 5$ % of the value measured initially. |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF<br>Compared to values measured initially |
| | Insulation resistance | As specified in section "Insulation Resistance" of this specification |
| **SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B** | | |
| 4.11 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 | No visible damage<br>Legible marking |
| | Capacitance | $\|\Delta C/C\| \leq 5$ % of the value measured in 4.11.1. |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF<br>Compared to values measured in 4.11.1. |
| | Voltage proof<br>1350 $V_{DC}$; 1 min between terminations | No permanent breakdown or flash-over |
| | Insulation resistance | ≥ 50 % of values specified in section "Insulation Resistance" of this specification |
| **SUB-GROUP C2** | | |
| 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 | |


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| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C2** | | |
| 4.12.3 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | $\|\Delta C/C\| \leq 5$ % of the value measured in 4.12.1 |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF<br>Compared to values measured in 4.12.1 |
| | Voltage proof<br>1350 $V_{DC}$; 1 min between terminations | No permanent breakdown or flash-over |
| | Insulation resistance | ≥ 50 % of values specified in section “Insulation Resistance” of this specification |
| **SUB-GROUP C3** | | |
| 4.13.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>For C ≤ 1 µF at 10 kHz<br>For C > 1 µF at 1 kHz | |
| 4.13 Impulse voltage | 3 successive impulses, full wave, peak voltage:<br>X2: 2.5 kV for C ≤ 1 µF<br>X2: 2.5 kV/√C for C > 1 µF<br>Max. 24 pulses | No self healing breakdowns or flash-over |
| 4.14 Endurance | Duration: 1000 h<br>1.25 x $U_{RAC}$ at 110 °C<br>Once in every hour the voltage is increased<br>to 1000 $V_{RMS}$ for 0.1 s via resistor of 47 Ω ± 5 % | |
| 4.14.7 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | $\|\Delta C/C\| \leq 10$ % compared to values measured in 4.13.1 |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF<br>Compared to values measured in 4.13.1 |
| | Voltage proof<br>1350 $V_{DC}$; 1 min between terminations<br>2120 $V_{AC}$; 1 min between terminations and case | No permanent breakdown or flash-over |
| | Insulation resistance | ≥ 50 % of values specified in section “Insulation Resistance” of this specification |


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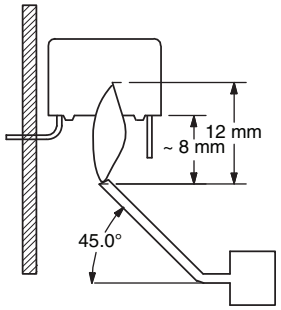
| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP C4** | | |
| 4.15 Charge and discharge | 10 000 cycles<br>charged to 435 $V_{DC}$<br>Discharge resistance:<br>$R = \frac{435\ V_{DC}}{1.25\ x\ C\ (dU/dt)}$ | |
| 4.15.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>For C ≤ 1 µF at 10 kHz<br>For C > 1 µF at 1 kHz | |
| 4.15.3 Final measurements | Capacitance | \|ΔC/C\| ≤ 10 % compared to values measured in 4.15.1. |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF<br>Compared to values measured in 4.15.1 |
| | Insulation resistance | ≥ 50 % of values specified in section “Insulation Resistance” of this specification |
| **SUB-GROUP C5** | | |
| 4.16 Radio frequency characteristic | Resonance frequency | ≥ 0.9 times the value as specified in section “Resonant Frequency” of this specification. |
| **SUB-GROUP C6** | | |
| 4.17 Passive flammability<br>Class B | Bore of gas jet: Ø 0.5 mm<br>Fuel: butane<br>Test duration for actual volume V in mm³:<br>V ≤ 250: 10 s<br>250 < V ≤ 500: 20 s<br>500 < V ≤ 1750: 30 s<br>V > 1750: 60 s<br>One flame application<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. |
| **SUB-GROUP C7** | | |
| 4.18 Active flammability | 20 cycles of 2.5 kV discharges on the test capacitor connected to $U_{RAC}$ | The cheese cloth around the capacitors shall not burn with a flame.<br>No electrical measurements are required. |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| GROUP C INSPECTION REQUIREMENTS | | |
|---|---|---|
| **SUB-CLAUSE NUMBER AND TEST** | **CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| **SUB-GROUP ADD 6** | | |
| A.6 Endurance | Duration:<br>1000 h for C ≤ 0.47 µF<br>500 h for C > 0.47 µF<br>1.0 x $U_{RAC}$ at 125 °C | |
| A.6.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>for C ≤ 1 µF at 10 kHz<br>for C > 1 µF at 1 kHz | |
| A.6.2 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | \|ΔC/C\| ≤ 10 % of the value measured in A.6.1 |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF |
| | Insulation resistance. | Compared to values measured in A.6.1<br>≥ 50 % of values specified in section “Insulation resistance” of this specification |
| **SUB-GROUP ADD 7** | | |
| A.7 Endurance | Duration: 500 h<br>0.625 x $U_{RDC}$ at 125 °C | |
| A.7.1 Initial measurements | Capacitance<br>Tangent of loss angle:<br>for C ≤ 1 µF at 10 kHz<br>for C > 1 µF at 1 kHz | |
| A.7.2 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | \|ΔC/C\| ≤ 10 % of the value measured in A.7.1 |
| | Tangent of loss angle | Increase of tan δ:<br>≤ 0.008 for: C ≤ 1 µF or<br>≤ 0.005 for: C > 1 µF |
| | Insulation resistance | Compared to values measured in A.7.1<br>≥ 50 % of values specified in section “Insulation resistance” of this specification |
| **SUB-GROUP ADD8** | | |
| A.8 Damp heat steady state with voltage | RH: 40 %; temp.: 93 °C, voltage: 310 $V_{AC}$<br>Duration: 21 days | |
| A.8.1 Initial measurements | Capacitance<br>Tangent of loss angle: at 10 kHz | |
| A.8.2 Final measurements | Visual examination | No visible damage<br>Legible marking |
| | Capacitance | \|ΔC/C\| ≤ 10 % of the value with initial measurement A.8.1 |
| | Tangent of loss angle | Increase of tan δ ≤ 0.024<br>Compared to values with initial measurement A.8.1 |
| | Insulation resistance | ≥ 50 % of values specified in section “Insulation Resistance” of this specification |


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| TEST CONDITIONS AND REQUIREMENTS ACCORDING AEC-Q200 REVISION C | | | | |
|---|---|---|---|---|
| **NO.** | **TEST NAME** | **REFERENCE** | **TEST CONDITIONS** | **PERFORMANCE REQUIREMENTS** |
| 1 | Pre- and post-stress electrical test | User spec. | - | - |
| 3 | High temperature exposure (storage) | MIL-STD 202 method 108 | 1000 h; 110 °C; unpowered | $\|\Delta C/C\| \leq \pm 5$ %<br>Increase of tan δ<br>0.008 for C ≤ 1 µF at 10 kHz or<br>0.005 for C > 1 µF at 1 kHz<br>IR ≥ 50 % of initial requirement |
| 4 | Temperature cycling | JESD22 method JA-104 | 1000 cycles: -55 °C to +110 °C<br>10 min. dwell time each | $\|\Delta C/C\| \leq \pm 5$ %<br>Increase of tan δ = 0.008 at 10 kHz<br>IR ≥ 50 % of initial requirement |
| 6 | Moisture resistance | MIL-STD 202 method 106 | 10 cycles at 24 h/cycle unpowered | $\|\Delta C/C\| \leq \pm 5$ %<br>Increase of tan δ<br>0.008 for C ≤ 1 µF at 10 kHz or<br>0.005 for C > 1 µF at 1 kHz<br>IR ≥ 50 % of initial requirement |
| 7 | Biased humidity | MIL-STD 202 method 103 | 1000 h; 40 °C; 93 % RH with $U_{RAC}$ | $\|\Delta C/C\| \leq \pm 10$ %<br>Increase of tan δ<br>0.008 for C ≤ 1 µF at 10 kHz or<br>0.005 for C > 1 µF at 1 kHz<br>IR ≥ 50 % of initial requirement |
| 8 | Operational life | MIL-STD 202 method 108 | $T_{amb}$ = 110 °C;<br>1000 h; $U_{test}$ = 1 x $U_{RAC}$ | $\|\Delta C/C\| \leq \pm 10$ %<br>Increase of tan δ<br>0.008 for C ≤ 1 µF at 10 kHz or<br>0.005 for C > 1 µF at 1 kHz<br>IR ≥ 50 % of initial requirement |
| 11 | Terminal strength (leaded) | MIL-STD 202 method 211 | Leaded device lead integrity only. | $\|\Delta C/C\| \leq \pm 5$ %<br>Increase of tan δ<br>0.008 for C ≤ 1 µF at 10 kHz or<br>0.005 for C > 1 µF at 1 kHz<br>IR = initial requirement |
| 12 | Resistance to solvents | MIL-STD 202 method 215 | | No visual damage<br>Legible marking |
| 13 | Mechanical shock | MIL-STD 202 method 213 | Figure a of method 213, condition C | No visual damage |
| 14 | Vibration | MIL-STD 202 method 204 | 5 *g*'s for 20 min;<br>12 cycles, 3 orientations | No visual damage |
| 15 | Resistance to soldering heat | MIL-STD 202 method 210 | 260 °C; 10 s | $\|\Delta C/C\| \leq \pm 5$ %<br>Increase of tan δ<br>0.008 for C ≤ 1 µF at 10 kHz or<br>0.005 for C > 1 µF at 1 kHz<br>IR = initial requirement |
| 18 | Solderability | J-STD-002 | 235 °C / 5 s | Good tinning as evidence by free flowing of the solder with wetting of terminations > 95 % |
| 19 | Electrical characterization | User spec. | - | - |
| 20 | Flammability | UL 94 | Electrical test not required | Maximum permitted burning time < 10 s |


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