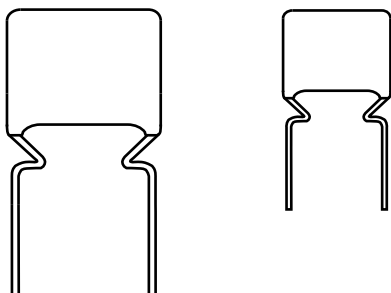


## DC Film Capacitors MKT Radial Lacquered Type



### FEATURES

- Available taped and loose in box
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

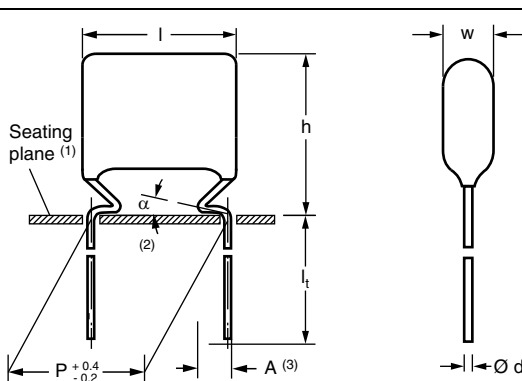
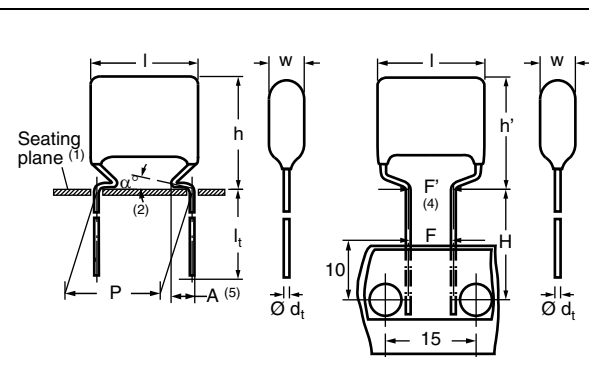
### APPLICATIONS

Blocking and coupling, bypass and energy reservoir

| QUICK REFERENCE DATA                            |                                                                                                    |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Capacitance range (E12 series)                  | <b>MKT467:</b> 0.001 $\mu$ F to 1.0 $\mu$ F<br><b>MKT468:</b> 0.039 $\mu$ F to 10.0 $\mu$ F        |
| Capacitance tolerance                           | $\pm 10\%$ , $\pm 5\%$                                                                             |
| Climatic testing class according to IEC 60068-1 | 55/105/56                                                                                          |
| Maximum application temperature                 | 105 °C                                                                                             |
| Reference standards                             | IEC 60384-2                                                                                        |
| Dielectric                                      | Polyester film                                                                                     |
| Electrodes                                      | Metallized                                                                                         |
| Construction                                    | Mono construction                                                                                  |
| Encapsulation                                   | Flame retardant epoxy material (UL-class 94 V-0)                                                   |
| Leads                                           | Tinned wire                                                                                        |
| Marking                                         | C-value; tolerance; rated voltage; code for manufacturer; manufacturer's type; manufacturer's logo |
| Rated (DC) voltage                              | 100 V, 250 V, 400 V, 630 V                                                                         |
| Rated (AC) voltage                              | 63 V, 160 V, 220 V, 250 V                                                                          |
| Rated temperature                               | 85 °C                                                                                              |

### Note

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

| DIMENSIONS                                                                          |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| MKT467                                                                              | MKT468                                                                               |
|  |  |

### Notes

- (1) Hole  $\varnothing$  1.0 mm for  $d_t = 0.6$  mm
- (2)  $0 \leq \alpha < 50^\circ$
- (3)  $A = 2.0 \text{ mm} \pm 0.5 \text{ mm}$
- (4)  $|F - F'| < 0.3 \text{ mm}$   
 $F = 7.5 \text{ mm} + 0.6 \text{ mm} / - 0.1 \text{ mm}$
- (5)  $A = 2.5 \text{ mm} + 1.4 \text{ mm} / - 0.5 \text{ mm} \pm 0.3 \text{ mm}$



## COMPOSITION OF CATALOG NUMBER: MKT467

| TYPE AND PITCHES |         | CAPACITANCE<br>(numerically) |  | MULTIPLIER<br>(nF) |   |
|------------------|---------|------------------------------|--|--------------------|---|
| 467              | 10.0 mm |                              |  | 0.1                | 2 |
|                  |         |                              |  | 1                  | 3 |
|                  |         |                              |  | 10                 | 4 |
|                  |         |                              |  | 100                | 5 |

|          |     |    |    |   |
|----------|-----|----|----|---|
| BFC2     | 467 | XX | YY | Y |
| 2222 (*) | 467 | XX | YY | Y |

(\*) Old ordering number

Example:  
104 = 10 x 10 = 100 nF

| TYPE | PACKAGING         | LEAD CONFIGURATION                                              | PREFERRED TYPES |       |       |       |       |
|------|-------------------|-----------------------------------------------------------------|-----------------|-------|-------|-------|-------|
|      |                   |                                                                 | C-TOL.          | 100 V | 250 V | 400 V | 630 V |
| 467  | Loose in box      | Lead length<br>3.5 mm + 1.0 mm/- 0.5 mm                         | ± 10 %          | 04    | 16    | 28    | 40    |
|      |                   |                                                                 | ± 5 %           | 05    | 17    | 29    | 41    |
|      |                   | Lead length<br>19.0 mm ± 4.0 mm                                 | ± 10 %          | 51    | 53    | 55    | 57    |
|      |                   |                                                                 | ± 5 %           | 52    | 54    | 56    | 58    |
|      | Taped on reel (1) | H = 16.0 mm; P <sub>0</sub> = 12.7 mm<br>Reel diameter = 500 mm | ± 10 %          | 06    | 18    | 30    | 42    |
|      |                   |                                                                 | ± 5 %           | 07    | 19    | 31    | 43    |

## Note

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

| SPECIFIC REFERENCE DATA: MKT467                                                      |                         |                          |                          |                     |
|--------------------------------------------------------------------------------------|-------------------------|--------------------------|--------------------------|---------------------|
| DESCRIPTION                                                                          | VALUE                   |                          |                          |                     |
| Tangent of loss angle:<br>C ≤ 0.1 μF<br>0.1 μF < C ≤ 0.47 μF<br>0.47 μF < C ≤ 1.0 μF | at 1 kHz                | at 10 kHz                | at 100 kHz               |                     |
|                                                                                      | ≤ 75 x 10 <sup>-4</sup> | ≤ 120 x 10 <sup>-4</sup> | ≤ 200 x 10 <sup>-4</sup> |                     |
|                                                                                      | ≤ 75 x 10 <sup>-4</sup> | ≤ 120 x 10 <sup>-4</sup> | ≤ 225 x 10 <sup>-4</sup> |                     |
|                                                                                      | ≤ 75 x 10 <sup>-4</sup> | ≤ 120 x 10 <sup>-4</sup> | -                        |                     |
| Rated voltage pulse slope (dU/dt) <sub>R</sub> at I <sub>max</sub> = 12.5 mm         | 100 V <sub>DC</sub>     | 250 V <sub>DC</sub>      | 400 V <sub>DC</sub>      | 630 V <sub>DC</sub> |
|                                                                                      | 30 V/μs                 | 120 V/μs                 | 170 V/μs                 | 120 V/μs            |
| R between leads, for C ≤ 0.33 μF<br>at 100 V; 1 min<br>at 500 V; 1 min               | > 15 000 MΩ             | > 30 000 MΩ              | > 30 000 MΩ              | > 30 000 MΩ         |
| RC between leads, for C > 0.33 μF<br>at 100 V; 1 min<br>at 500 V; 1 min              | > 5000 s                | > 10 000 s               | > 10 000 s               | > 10 000 s          |
| R between interconnecting leads and casing,<br>at 100 V; 1 min<br>at 500 V; 1 min    | > 30 000 MΩ             |                          |                          |                     |
| Withstanding (DC) voltage (cut off current 10 mA) (1);<br>rise time ≤ 1000 V/s       | 160 V; 1 min            | 400 V; 1 min             | 640 V; 1 min             | 1008 V; 1 min       |
| Withstanding (DC) voltage between leads and case                                     | 200 V; 1 min            | 500 V; 1 min             | 800 V; 1 min             | 1260 V; 1 min       |
| Maximum application temperature                                                      | 105 °C                  |                          |                          |                     |

## Note

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



| ELECTRICAL DATA AND ORDERING INFORMATION: MKT467 |                                                                                         |                                                                                 |                            |                                                |                   |                                   |                   |                                          |                   |                          |
|--------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------|------------------------------------------------|-------------------|-----------------------------------|-------------------|------------------------------------------|-------------------|--------------------------|
| U <sub>RDC</sub><br>(V)                          | CAP.<br>(μF)                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup> | CATALOG NUMBER BFC2 467 XYYYY AND PACKAGING    |                   |                                   |                   |                                          |                   |                          |
|                                                  |                                                                                         |                                                                                 |                            | LOOSE IN BOX                                   |                   |                                   |                   | REEL                                     |                   | C-VALUE                  |
|                                                  |                                                                                         |                                                                                 |                            | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm / - 0.5 mm |                   | l <sub>t</sub> = 19.0 mm ± 4.0 mm |                   | H = 16.0 mm;<br>P <sub>0</sub> = 12.7 mm |                   |                          |
|                                                  |                                                                                         |                                                                                 |                            | C-TOL. =<br>± 10 %                             | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                       | C-TOL. =<br>± 5 % |                          |
|                                                  |                                                                                         |                                                                                 |                            | XX<br>(SPQ)                                    | XX<br>(SPQ)       | XX<br>(SPQ)                       | XX<br>(SPQ)       | XX<br>(SPQ)                              | XX<br>(SPQ)       |                          |
| 100                                              | Pitch = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm (U <sub>RAC</sub> = 63 V)  |                                                                                 |                            |                                                |                   |                                   |                   |                                          |                   |                          |
|                                                  | 0.056<br>0.068<br>0.082<br>0.10                                                         | 4.0 x 14.0 x 12.5                                                               | 0.37                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 563<br>683<br>823<br>104 |
|                                                  | 0.12                                                                                    | 4.3 x 14.3 x 12.5                                                               | 0.40                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 124                      |
|                                                  | 0.15                                                                                    | 4.0 x 14.0 x 12.5                                                               | 0.37                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 154                      |
|                                                  | 0.18                                                                                    | 4.2 x 14.2 x 12.5                                                               | 0.39                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 184                      |
|                                                  | 0.22                                                                                    | 4.5 x 14.6 x 12.5                                                               | 0.43                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1300)                          | 07...<br>(1300)   | 224                      |
|                                                  | 0.27                                                                                    | 4.2 x 14.2 x 12.5                                                               | 0.39                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 274                      |
|                                                  | 0.33                                                                                    | 4.6 x 14.6 x 12.5                                                               | 0.44                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1300)                          | 07...<br>(1300)   | 334                      |
|                                                  | 0.39                                                                                    | 4.0 x 14.0 x 12.5                                                               | 0.37                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 394                      |
|                                                  | 0.47                                                                                    | 4.2 x 14.2 x 12.5                                                               | 0.39                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1500)                          | 07...<br>(1500)   | 474                      |
|                                                  | 0.56                                                                                    | 4.6 x 14.6 x 12.5                                                               | 0.44                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1500)                   | 52...<br>(1500)   | 06...<br>(1300)                          | 07...<br>(1300)   | 564                      |
|                                                  | 0.68                                                                                    | 5.0 x 15.0 x 12.5                                                               | 0.50                       | 04...<br>(1500)                                | 05...<br>(1500)   | 51...<br>(1250)                   | 52...<br>(1250)   | 06...<br>(1200)                          | 07...<br>(1200)   | 684                      |
|                                                  | 0.82                                                                                    | 5.5 x 15.5 x 12.5                                                               | 0.60                       | 04...<br>(1500)                                | 05...<br>(1500)   | 51...<br>(1000)                   | 52...<br>(1000)   | 06...<br>(1100)                          | 07...<br>(1100)   | 824                      |
|                                                  | 1.0                                                                                     | 6.0 x 16.0 x 12.5                                                               | 0.75                       | 04...<br>(1250)                                | 05...<br>(1250)   | 51...<br>(1000)                   | 52...<br>(1000)   | 06...<br>(1000)                          | 07...<br>(1000)   | 105                      |
| 250                                              | Pitch = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm (U <sub>RAC</sub> = 160 V) |                                                                                 |                            |                                                |                   |                                   |                   |                                          |                   |                          |
|                                                  | 0.027                                                                                   | 4.2 x 14.2 x 12.5                                                               | 0.39                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 273                      |
|                                                  | 0.033                                                                                   | 4.6 x 14.6 x 12.5                                                               | 0.44                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1300)                          | 19...<br>(1300)   | 333                      |
|                                                  | 0.039                                                                                   | 4.0 x 14.0 x 12.5                                                               | 0.37                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 393                      |
|                                                  | 0.047                                                                                   | 4.1 x 14.1 x 12.5                                                               | 0.38                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 473                      |
|                                                  | 0.056                                                                                   | 4.0 x 14.0 x 12.5                                                               | 0.37                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 563                      |
|                                                  | 0.068                                                                                   | 4.1 x 14.1 x 12.5                                                               | 0.38                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 683                      |
|                                                  | 0.082                                                                                   | 4.4 x 14.4 x 12.5                                                               | 0.41                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 823                      |
|                                                  | 0.10                                                                                    | 4.0 x 14.0 x 12.5                                                               | 0.37                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 104                      |
|                                                  | 0.12                                                                                    | 4.3 x 14.3 x 12.5                                                               | 0.40                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1500)                   | 54...<br>(1500)   | 18...<br>(1500)                          | 19...<br>(1500)   | 124                      |
|                                                  | 0.15                                                                                    | 4.8 x 14.8 x 12.5                                                               | 0.48                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1250)                   | 54...<br>(1250)   | 18...<br>(1300)                          | 19...<br>(1300)   | 154                      |
|                                                  | 0.18                                                                                    | 5.2 x 15.2 x 12.5                                                               | 0.52                       | 16...<br>(1500)                                | 17...<br>(1500)   | 53...<br>(1000)                   | 54...<br>(1000)   | 18...<br>(1200)                          | 19...<br>(1200)   | 184                      |
| 0.22                                             | 5.8 x 15.8 x 12.5                                                                       | 0.67                                                                            | 16...<br>(1500)            | 17...<br>(1500)                                | 53...<br>(1000)   | 54...<br>(1000)                   | 18...<br>(1100)   | 19...<br>(1100)                          | 224               |                          |

**ELECTRICAL DATA AND ORDERING INFORMATION: MKT467**

| U <sub>RDC</sub><br>(V) | CAP.<br>(μF)                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup> 1 | CATALOG NUMBER BFC2 467 XXYYY AND PACKAGING    |                   |                                   |                   |                                          |                   | C-VALUE                  |
|-------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------|------------------------------------------------|-------------------|-----------------------------------|-------------------|------------------------------------------|-------------------|--------------------------|
|                         |                                                                                         |                                                                                 |                              | LOOSE IN BOX                                   |                   |                                   |                   | REEL                                     |                   |                          |
|                         |                                                                                         |                                                                                 |                              | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm / - 0.5 mm |                   | l <sub>t</sub> = 19.0 mm ± 4.0 mm |                   | H = 16.0 mm;<br>P <sub>0</sub> = 12.7 mm |                   |                          |
|                         |                                                                                         |                                                                                 |                              | C-TOL. =<br>± 10 %                             | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                       | C-TOL. =<br>± 5 % |                          |
|                         |                                                                                         |                                                                                 |                              | XX<br>(SPQ)                                    | XX<br>(SPQ)       | XX<br>(SPQ)                       | XX<br>(SPQ)       | XX<br>(SPQ)                              | XX<br>(SPQ)       |                          |
| 400                     | Pitch = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm (U <sub>RAC</sub> = 220 V) |                                                                                 |                              |                                                |                   |                                   |                   |                                          |                   |                          |
|                         | 0.0010<br>0.0012<br>0.0015<br>0.0018                                                    | 4.5 x 14.5 x 12.5                                                               | 0.43                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 102<br>122<br>152<br>182 |
|                         | 0.0022                                                                                  | 4.0 x 14.0 x 12.5                                                               | 0.37                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 222                      |
|                         | 0.0027                                                                                  | 4.3 x 14.3 x 12.5                                                               | 0.40                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 272                      |
|                         | 0.0033                                                                                  | 4.6 x 14.6 x 12.5                                                               | 0.44                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 332                      |
|                         | 0.0039                                                                                  | 4.0 x 14.0 x 12.5                                                               | 0.37                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 393                      |
|                         | 0.0047                                                                                  | 4.1 x 14.2 x 12.5                                                               | 0.38                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 472                      |
|                         | 0.0056                                                                                  | 4.6 x 14.6 x 12.5                                                               | 0.44                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 562                      |
|                         | 0.0068                                                                                  | 4.2 x 14.2 x 12.5                                                               | 0.39                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 682                      |
|                         | 0.0082                                                                                  | 4.6 x 14.6 x 12.5                                                               | 0.44                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 822                      |
|                         | 0.010                                                                                   | 4.1 x 14.1 x 12.5                                                               | 0.38                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 103                      |
|                         | 0.012                                                                                   | 4.5 x 14.5 x 12.5                                                               | 0.43                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 123                      |
|                         | 0.015                                                                                   | 4.1 x 14.1 x 12.5                                                               | 0.38                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 153                      |
|                         | 0.018                                                                                   | 4.5 x 14.5 x 12.5                                                               | 0.43                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 183                      |
|                         | 0.022                                                                                   | 4.0 x 14.0 x 12.5                                                               | 0.37                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 223                      |
|                         | 0.027                                                                                   | 4.2 x 14.2 x 12.5                                                               | 0.39                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 273                      |
|                         | 0.033                                                                                   | 4.6 x 14.7 x 12.5                                                               | 0.44                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1300)                          | 31...<br>(1300)   | 333                      |
|                         | 0.039                                                                                   | 5.0 x 14.9 x 12.5                                                               | 0.50                         | 28...<br>(1500)                                | 29...<br>(1500)   | 55...<br>(1250)                   | 56...<br>(1250)   | 30...<br>(1200)                          | 31...<br>(1200)   | 393                      |
|                         | 0.047                                                                                   | 4.1 x 14.1 x 12.5                                                               | 0.38                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 473                      |
|                         | 0.056                                                                                   | 4.4 x 14.4 x 12.5                                                               | 0.41                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1500)                   | 56...<br>(1500)   | 30...<br>(1500)                          | 31...<br>(1500)   | 563                      |
|                         | 0.068                                                                                   | 4.8 x 14.8 x 12.5                                                               | 0.48                         | 28...<br>(2000)                                | 29...<br>(2000)   | 55...<br>(1250)                   | 56...<br>(1250)   | 30...<br>(1300)                          | 31...<br>(1300)   | 683                      |
|                         | 0.082                                                                                   | 5.4 x 15.3 x 12.5                                                               | 0.57                         | 28...<br>(1500)                                | 29...<br>(1500)   | 55...<br>(1000)                   | 56...<br>(1000)   | 30...<br>(1200)                          | 31...<br>(1200)   | 823                      |
|                         | 0.10                                                                                    | 5.7 x 15.7 x 12.5                                                               | 0.64                         | 28...<br>(1500)                                | 29...<br>(1500)   | 55...<br>(1000)                   | 56...<br>(1000)   | 30...<br>(1100)                          | 31...<br>(1100)   | 104                      |

**ELECTRICAL DATA AND ORDERING INFORMATION: MKT467**

| U <sub>RDC</sub><br>(V) | CAP.<br>(μF)                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup> | CATALOG NUMBER BFC2 467 XYYYY AND PACKAGING    |                   |                                   |                   |                                          |                   |         |       |
|-------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------|------------------------------------------------|-------------------|-----------------------------------|-------------------|------------------------------------------|-------------------|---------|-------|
|                         |                                                                                         |                                                                                 |                            | LOOSE IN BOX                                   |                   |                                   |                   | REEL                                     |                   | C-VALUE |       |
|                         |                                                                                         |                                                                                 |                            | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm / - 0.5 mm |                   | l <sub>t</sub> = 19.0 mm ± 4.0 mm |                   | H = 16.0 mm;<br>P <sub>0</sub> = 12.7 mm |                   |         |       |
|                         |                                                                                         |                                                                                 |                            | C-TOL. =<br>± 10 %                             | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                       | C-TOL. =<br>± 5 % |         |       |
|                         |                                                                                         |                                                                                 |                            | XX<br>(SPQ)                                    | XX<br>(SPQ)       | XX<br>(SPQ)                       | XX<br>(SPQ)       | XX<br>(SPQ)                              | XX<br>(SPQ)       |         | ..YYY |
| 630                     | Pitch = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm (U <sub>RAC</sub> = 250 V) |                                                                                 |                            |                                                |                   |                                   |                   |                                          |                   |         |       |
|                         | 0.010                                                                                   | 4.1 x 14.1 x 12.5                                                               | 0.38                       | 40...<br>(2000)                                | 41...<br>(2000)   | 57...<br>(1500)                   | 58...<br>(1500)   | 42...<br>(1500)                          | 43...<br>(1500)   | 103     |       |
|                         | 0.012                                                                                   | 4.5 x 14.5 x 12.5                                                               | 0.43                       | 40...<br>(2000)                                | 41...<br>(2000)   | 57...<br>(1500)                   | 58...<br>(1500)   | 42...<br>(1300)                          | 43...<br>(1300)   | 123     |       |
|                         | 0.015                                                                                   | 4.9 x 14.9 x 12.5                                                               | 0.49                       | 40...<br>(2000)                                | 41...<br>(2000)   | 57...<br>(1250)                   | 58...<br>(1250)   | 42...<br>(1200)                          | 43...<br>(1200)   | 153     |       |
|                         | 0.018                                                                                   | 5.4 x 15.4 x 12.5                                                               | 0.57                       | 40...<br>(1500)                                | 41...<br>(1500)   | 57...<br>(1000)                   | 58...<br>(1000)   | 42...<br>(1100)                          | 43...<br>(1100)   | 183     |       |
|                         | 0.022                                                                                   | 4.8 x 14.8 x 12.5                                                               | 0.48                       | 40...<br>(2000)                                | 41...<br>(2000)   | 57...<br>(1250)                   | 58...<br>(1250)   | 42...<br>(1300)                          | 43...<br>(1300)   | 223     |       |
|                         | 0.027                                                                                   | 5.3 x 15.3 x 12.5                                                               | 0.55                       | 40...<br>(2000)                                | 41...<br>(2000)   | 57...<br>(1000)                   | 58...<br>(1000)   | 42...<br>(1200)                          | 43...<br>(1200)   | 273     |       |
|                         | 0.033                                                                                   | 5.9 x 15.9 x 12.5                                                               | 0.70                       | 40...<br>(1500)                                | 41...<br>(1500)   | 57...<br>(1000)                   | 58...<br>(1000)   | 42...<br>(1100)                          | 43...<br>(1100)   | 333     |       |

**Notes**

- SPQ = Standard Packing Quantity

<sup>(1)</sup> Net weight for short lead product only



## COMPOSITION OF CATALOG NUMBER: MKT468

| TYPE AND PITCHES |                | CAPACITANCE<br>(numerically)       |     |    | MULTIPLIER<br>(nF) |   |
|------------------|----------------|------------------------------------|-----|----|--------------------|---|
| 468              | 15.0 mm/7.5 mm |                                    |     |    | 0.1                | 2 |
|                  | 15.0 mm        |                                    |     |    | 1                  | 3 |
|                  | 22.5 mm        |                                    |     |    | 10                 | 4 |
|                  | 27.5 mm        |                                    |     |    | 100                | 5 |
|                  |                | Example:<br>104 = 10 x 10 = 100 nF |     |    |                    |   |
|                  |                | BFC2                               | 468 | XX | YY                 | Y |
|                  |                | 2222 (*)                           | 468 | XX | YY                 | Y |

(\*) Old ordering number

(\*) Old ordering number

| TYPE | PACKAGING                                   | LEAD CONFIGURATION                                                             | PREFERRED TYPES                                        |       |       |       |       |
|------|---------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------|-------|-------|-------|-------|
|      |                                             |                                                                                | C-TOL.                                                 | 100 V | 250 V | 400 V | 630 V |
| 468  | Loose in box                                | Lead length 3.5 mm + 1.0 mm/- 0.5 mm<br>(Pitch 10 mm and 15 mm)                | ± 10 %                                                 | 04    | 16    | 28    | 40    |
|      |                                             | Lead length 3.5 mm ± 0.5 mm<br>(Pitch 22.5 mm and 27.5 mm)                     | ± 5 %                                                  | 05    | 17    | 29    | 41    |
|      |                                             | Long leads:                                                                    | ± 10 %                                                 | 51    | 53    | 55    | 57    |
|      |                                             | 19.0 mm ± 4.0 mm for lead pitch = 15.0 mm                                      | ± 5 %                                                  | 52    | 54    | 56    | 58    |
|      | Taped on reel <sup>(1)</sup><br>(bent back) | 25.0 mm ± 4.0 mm for lead pitch = 22.5 mm                                      | ± 10 %                                                 | 61    | 63    | 65    | 67    |
|      |                                             | 24.0 mm ± 4.0 mm for lead pitch = 27.5 mm                                      | ± 5 %                                                  | 62    | 64    | 66    | 68    |
|      | Taped on reel <sup>(1)</sup>                | H = 16.0 mm; P <sub>0</sub> = 15.0 mm<br>Reel diameter = 500 mm <sup>(2)</sup> | Dimensions of these code numbers stay between brackets |       |       |       |       |
|      |                                             | H = 16.0 mm; P <sub>0</sub> = 12.7 mm<br>Reel diameter = 500 mm                | ± 10 %                                                 | 06    | 18    | 30    | 42    |
|      |                                             |                                                                                | ± 5 %                                                  | 07    | 19    | 31    | 43    |

## Notes

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

(2) Small reel diameter = 356 mm is available on request

## SPECIFIC REFERENCE DATA: MKT468

| DESCRIPTION                                                                                | VALUE                   |                          |                          |                     |
|--------------------------------------------------------------------------------------------|-------------------------|--------------------------|--------------------------|---------------------|
| Tangent of loss angle:                                                                     | at 1 kHz                | at 10 kHz                | at 100 kHz               |                     |
| C ≤ 0.1 μF                                                                                 | ≤ 75 x 10 <sup>-4</sup> | ≤ 120 x 10 <sup>-4</sup> | ≤ 200 x 10 <sup>-4</sup> |                     |
| 0.1 μF < C ≤ 0.47 μF                                                                       | ≤ 75 x 10 <sup>-4</sup> | ≤ 120 x 10 <sup>-4</sup> | ≤ 225 x 10 <sup>-4</sup> |                     |
| 0.47 μF < C ≤ 1.0 μF                                                                       | ≤ 75 x 10 <sup>-4</sup> | ≤ 150 x 10 <sup>-4</sup> | -                        |                     |
| Rated voltage pulse slope (dU/dt) <sub>R</sub> at                                          | 100 V <sub>DC</sub>     | 250 V <sub>DC</sub>      | 400 V <sub>DC</sub>      | 630 V <sub>DC</sub> |
| I <sub>max.</sub> = 12.5 mm                                                                | 30 V/μs                 | 120 V/μs                 | 170 V/μs                 | 120 V/μs            |
| I <sub>max.</sub> = 17.5 mm                                                                | 20 V/μs                 | 45 V/μs                  | 65 V/μs                  | 90 V/μs             |
| I <sub>max.</sub> = 26.0 mm                                                                | 10 V/μs                 | 20 V/μs                  | 30 V/μs                  | 35 V/μs             |
| I <sub>max.</sub> = 30.0 mm                                                                |                         | 15 V/μs                  | 25 V/μs                  | 30 V/μs             |
| R between leads, for C ≤ 0.33 μF                                                           |                         |                          |                          |                     |
| at 100 V; 1 min                                                                            | > 15 000 MΩ             | > 30 000 MΩ              | > 30 000 MΩ              |                     |
| at 500 V; 1 min                                                                            |                         |                          |                          | > 30 000 MΩ         |
| RC between leads, for C > 0.33 μF                                                          |                         |                          |                          |                     |
| at 100 V; 1 min                                                                            | > 5000 s                | > 10 000 s               | > 10 000 s               |                     |
| at 500 V; 1 min                                                                            |                         |                          |                          | > 10 000 s          |
| R between interconnecting leads and casing,                                                |                         |                          |                          |                     |
| at 100 V; 1 min                                                                            | > 30 000 MΩ             | > 30 000 MΩ              | > 30 000 MΩ              |                     |
| at 500 V; 1 min                                                                            |                         |                          |                          | > 30 000 MΩ         |
| Withstanding (DC) voltage (cut off current 10 mA) <sup>(1)</sup> ;<br>rise time ≤ 1000 V/s | 160 V; 1 min            | 400 V; 1 min             | 640 V; 1 min             | 1008 V; 1 min       |
| Withstanding (DC) voltage between leads and case                                           | 200 V; 1 min            | 500 V; 1 min             | 800 V; 1 min             | 1260 V; 1 min       |
| Maximum application temperature                                                            | 105 °C                  |                          |                          |                     |

## Note

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

**ELECTRICAL DATA AND ORDERING INFORMATION: MKT468**

| U <sub>RDC</sub><br>(V) | CAP.<br>(μF)                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h (h') <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup> | CATALOG NUMBER BFC2 468 XYYYY AND PACKAGING    |                   |                                      |                   |                                         |                   |                                        |                   |             |             |
|-------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------|------------------------------------------------|-------------------|--------------------------------------|-------------------|-----------------------------------------|-------------------|----------------------------------------|-------------------|-------------|-------------|
|                         |                                                                                         |                                                                                      |                            | LOOSE IN BOX                                   |                   |                                      |                   | REEL<br>H = 16.0 mm                     |                   |                                        |                   | C-<br>VALUE |             |
|                         |                                                                                         |                                                                                      |                            |                                                |                   |                                      |                   | ORIGINAL PITCH                          |                   | BENT BACK PITCH                        |                   |             |             |
|                         |                                                                                         |                                                                                      |                            | C-TOL. =<br>± 10 %                             | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                   | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                      | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                     | C-TOL. =<br>± 5 % |             |             |
|                         |                                                                                         |                                                                                      |                            | XX<br>(SPQ)                                    | XX<br>(SPQ)       | XX<br>(SPQ)                          | XX<br>(SPQ)       | XX<br>(SPQ)                             | XX<br>(SPQ)       | XX<br>(SPQ)                            | XX<br>(SPQ)       | XX<br>(SPQ) | XX<br>(SPQ) |
| 100                     | Pitch = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 63 V)  |                                                                                      |                            |                                                |                   |                                      |                   |                                         |                   |                                        |                   |             |             |
|                         |                                                                                         |                                                                                      |                            | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm / - 0.5 mm |                   | l <sub>t</sub> = 19.0 mm<br>± 4.0 mm |                   | P = 15 mm<br>P <sub>0</sub> = 12.7 mm   |                   | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |             |
|                         | 1.2                                                                                     | 5.5 x 14.5 (16.0) x 17.5                                                             | 0.90                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1250)                      | 52...<br>(1250)   | 06...<br>(1100)                         | 07...<br>(1100)   | 61...<br>(900)                         | 62...<br>(900)    | 125         |             |
|                         | 1.5                                                                                     | 6.0 x 15.0 (16.5) x 17.5                                                             | 1.00                       | 04...<br>(2000)                                | 05...<br>(2000)   | 51...<br>(1250)                      | 52...<br>(1250)   | 06...<br>(1000)                         | 07...<br>(1000)   | 61...<br>(800)                         | 62...<br>(800)    | 155         |             |
|                         | 1.8                                                                                     | 6.5 x 15.5 (17.0) x 17.5                                                             | 1.15                       | 04...<br>(1500)                                | 05...<br>(1500)   | 51...<br>(1000)                      | 52...<br>(1000)   | 06...<br>(900)                          | 07...<br>(900)    | 61...<br>(750)                         | 62...<br>(750)    | 185         |             |
|                         | 2.2                                                                                     | 7.0 x 16.0 (17.5) x 17.5                                                             | 1.25                       | 04...<br>(1250)                                | 05...<br>(1250)   | 51...<br>(1000)                      | 52...<br>(1000)   | 06...<br>(800)                          | 07...<br>(800)    | 61...<br>(700)                         | 62...<br>(700)    | 225         |             |
|                         | 2.7                                                                                     | 8.0 x 17.0 (18.5) x 17.5                                                             | 1.50                       | 04...<br>(1000)                                | 05...<br>(1000)   | 51...<br>(1000)                      | 52...<br>(1000)   | 06...<br>(750)                          | 07...<br>(750)    | 61...<br>(600)                         | 62...<br>(600)    | 275         |             |
|                         | 3.3                                                                                     | 8.5 x 17.5 (19.0) x 17.5                                                             | 1.70                       | 04...<br>(1000)                                | 05...<br>(1000)   | 51...<br>(1000)                      | 52...<br>(1000)   | 06...<br>(700)                          | 07...<br>(700)    | 61...<br>(550)                         | 62...<br>(550)    | 335         |             |
|                         | Pitch = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 63 V)  |                                                                                      |                            |                                                |                   |                                      |                   |                                         |                   |                                        |                   |             |             |
|                         |                                                                                         |                                                                                      |                            | l <sub>t</sub> = 3.5 mm ± 0.5 mm               |                   | l <sub>t</sub> = 25.0 mm<br>± 4.0 mm |                   | P = 22.5 mm<br>P <sub>0</sub> = 12.7 mm |                   | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |             |
|                         | 3.9                                                                                     | 6.5 x 18.5 x 26.0                                                                    | 2.1                        | 04...<br>(1000)                                | 05...<br>(1000)   | 51...<br>(750)                       | 52...<br>(750)    |                                         |                   |                                        |                   | 395         |             |
|                         | 4.7                                                                                     | 7.0 x 19.5 x 26.0                                                                    | 2.3                        | 04...<br>(900)                                 | 05...<br>(900)    | 51...<br>(700)                       | 52...<br>(700)    |                                         |                   |                                        |                   | 475         |             |
|                         | 5.6                                                                                     | 7.5 x 20.0 x 26.0                                                                    | 2.5                        | 04...<br>(750)                                 | 05...<br>(750)    | 51...<br>(600)                       | 52...<br>(600)    |                                         |                   |                                        |                   | 565         |             |
|                         | 6.8                                                                                     | 8.5 x 21.5 x 26.0                                                                    | 3.2                        | 04...<br>(750)                                 | 05...<br>(750)    | 51...<br>(500)                       | 52...<br>(500)    |                                         |                   |                                        |                   | 685         |             |
|                         | 8.2                                                                                     | 9.5 x 22.5 x 26.0                                                                    | 3.4                        | 04...<br>(700)                                 | 05...<br>(700)    | 51...<br>(500)                       | 52...<br>(500)    |                                         |                   |                                        |                   | 825         |             |
|                         | 10.0                                                                                    | 10.5 x 23.5 x 26.0                                                                   | 3.8                        | 04...<br>(500)                                 | 05...<br>(500)    | 51...<br>(400)                       | 52...<br>(400)    |                                         |                   |                                        |                   | 106         |             |
| 250                     | Pitch = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 160 V) |                                                                                      |                            |                                                |                   |                                      |                   |                                         |                   |                                        |                   |             |             |
|                         |                                                                                         |                                                                                      |                            | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm/- 0.5 mm   |                   | l <sub>t</sub> = 19.0 mm<br>± 4.0 mm |                   | P = 15 mm<br>P <sub>0</sub> = 12.7 mm   |                   | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |             |
|                         | 0.27                                                                                    | 5.0 x 14.0 (15.5) x 17.5                                                             | 0.80                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1250)                      | 54...<br>(1250)   | 18...<br>(1200)                         | 19...<br>(1200)   | 63...<br>(1000)                        | 64...<br>(1000)   | 274         |             |
|                         | 0.33                                                                                    | 5.5 x 14.5 (16.0) x 17.5                                                             | 0.90                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1250)                      | 54...<br>(1250)   | 18...<br>(1100)                         | 19...<br>(1100)   | 63...<br>(900)                         | 64...<br>(900)    | 334         |             |
|                         | 0.39                                                                                    | 6.0 x 15.0 (16.5) x 17.5                                                             | 1.00                       | 16...<br>(2000)                                | 17...<br>(2000)   | 53...<br>(1250)                      | 54...<br>(1250)   | 18...<br>(1000)                         | 19...<br>(1000)   | 63...<br>(800)                         | 64...<br>(800)    | 394         |             |
|                         | 0.47                                                                                    | 6.5 x 15.5 (17.0) x 17.5                                                             | 1.15                       | 16...<br>(1500)                                | 17...<br>(1500)   | 53...<br>(1000)                      | 54...<br>(1000)   | 18...<br>(900)                          | 19...<br>(900)    | 63...<br>(750)                         | 64...<br>(750)    | 474         |             |
|                         | 0.56                                                                                    | 7.5 x 16.5 (18.0) x 17.5                                                             | 1.30                       | 16...<br>(1250)                                | 17...<br>(1250)   | 53...<br>(1000)                      | 54...<br>(1000)   | 18...<br>(800)                          | 19...<br>(800)    | 63...<br>(650)                         | 64...<br>(650)    | 564         |             |
|                         | 0.68                                                                                    | 8.0 x 17.0 (18.5) x 17.5                                                             | 1.50                       | 16...<br>(1000)                                | 17...<br>(1000)   | 53...<br>(1000)                      | 54...<br>(1000)   | 18...<br>(750)                          | 19...<br>(750)    | 63...<br>(600)                         | 64...<br>(600)    | 684         |             |
|                         | 0.82                                                                                    | 8.5 x 17.5 (19.0) x 17.5                                                             | 1.70                       | 16...<br>(1000)                                | 17...<br>(1000)   | 53...<br>(1000)                      | 54...<br>(1000)   | 18...<br>(700)                          | 19...<br>(700)    | 63...<br>(550)                         | 64...<br>(550)    | 824         |             |
|                         | 1.0                                                                                     | 8.0 x 20.0 (21.5) x 17.5                                                             | 2.10                       | 16...<br>(1000)                                | 17...<br>(1000)   | 53...<br>(900)                       | 54...<br>(900)    | 18...<br>(750)                          | 19...<br>(750)    | 63...<br>(600)                         | 64...<br>(600)    | 105         |             |



| ELECTRICAL DATA AND ORDERING INFORMATION: MKT468                                                                        |                                                                                         |                                                                                      |                                  |                                                |                                      |                                      |                                         |                                         |                                        |                                        |                 |             |                |       |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------------|-----------------------------------------|----------------------------------------|----------------------------------------|-----------------|-------------|----------------|-------|
| U <sub>RDC</sub><br>(V)                                                                                                 | CAP.<br>(μF)                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h (h') <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup>       | CATALOG NUMBER BFC2 468 XYYYY AND PACKAGING    |                                      |                                      |                                         |                                         |                                        |                                        |                 | C-<br>VALUE |                |       |
|                                                                                                                         |                                                                                         |                                                                                      |                                  | LOOSE IN BOX                                   |                                      |                                      |                                         | REEL                                    |                                        |                                        |                 |             |                |       |
|                                                                                                                         |                                                                                         |                                                                                      |                                  |                                                |                                      |                                      |                                         | H = 16.0 mm                             |                                        |                                        |                 |             |                |       |
|                                                                                                                         |                                                                                         |                                                                                      |                                  | C-TOL. =<br>± 10 %                             |                                      | C-TOL. =<br>± 5 %                    |                                         | C-TOL. =<br>± 10 %                      |                                        | C-TOL. =<br>± 5 %                      |                 |             | ORIGINAL PITCH |       |
| XX<br>(SPQ)                                                                                                             |                                                                                         | XX<br>(SPQ)                                                                          |                                  | XX<br>(SPQ)                                    |                                      | XX<br>(SPQ)                          |                                         | XX<br>(SPQ)                             |                                        | XX<br>(SPQ)                            |                 | XX<br>(SPQ) |                | ..YYY |
| 250                                                                                                                     | Pitch = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 160 V) |                                                                                      |                                  |                                                |                                      |                                      |                                         |                                         |                                        |                                        |                 |             |                |       |
|                                                                                                                         |                                                                                         |                                                                                      |                                  | l <sub>t</sub> = 3.5 mm<br>± 0.5 mm            |                                      | l <sub>t</sub> = 25.0 mm<br>± 4.0 mm |                                         | P = 22.5 mm<br>P <sub>0</sub> = 12.7 mm |                                        | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                 |             |                |       |
|                                                                                                                         | 1.2                                                                                     | 7.0 x 19.0 x 26.0                                                                    | 2.3                              | 16...<br>(1000)                                | 17...<br>(1000)                      | 53...<br>(700)                       | 54...<br>(700)                          |                                         |                                        |                                        |                 | 125         |                |       |
|                                                                                                                         | 1.5                                                                                     | 8.0 x 21.0 x 26.0                                                                    | 2.8                              | 16...<br>(750)                                 | 17...<br>(750)                       | 53...<br>(500)                       | 54...<br>(500)                          |                                         |                                        |                                        |                 | 155         |                |       |
|                                                                                                                         | 1.8                                                                                     | 9.0 x 22.0 x 26.0                                                                    | 3.3                              | 16...<br>(750)                                 | 17...<br>(750)                       | 53...<br>(500)                       | 54...<br>(500)                          |                                         |                                        |                                        |                 | 185         |                |       |
|                                                                                                                         | 2.2                                                                                     | 9.8 x 23.0 x 26.0                                                                    | 3.4                              | 16...<br>(750)                                 | 17...<br>(750)                       | 53...<br>(450)                       | 54...<br>(450)                          |                                         |                                        |                                        |                 | 225         |                |       |
|                                                                                                                         | 2.7                                                                                     | 11.0 x 24.0 x 26.0                                                                   | 4.0                              | 16...<br>(500)                                 | 17...<br>(500)                       | 53...<br>(400)                       | 54...<br>(400)                          |                                         |                                        |                                        |                 | 275         |                |       |
|                                                                                                                         | 3.3                                                                                     | 12.5 x 25.5 x 26.0                                                                   | 4.5                              | 16...<br>(500)                                 | 17...<br>(500)                       | 53...<br>(300)                       | 54...<br>(300)                          |                                         |                                        |                                        |                 | 335         |                |       |
|                                                                                                                         | 3.9                                                                                     | 13.5 x 26.5 x 26.0                                                                   | 5.5                              | 16...<br>(400)                                 | 17...<br>(400)                       | 53...<br>(300)                       | 54...<br>(300)                          |                                         |                                        |                                        |                 | 395         |                |       |
|                                                                                                                         | 4.7                                                                                     | 14.9 x 28.0 x 26.0                                                                   | 6.3                              | 16...<br>(250)                                 | 17...<br>(250)                       | 53...<br>(250)                       | 54...<br>(250)                          |                                         |                                        |                                        |                 | 475         |                |       |
| Pitch = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; A = 2.5 mm + 1.4 mm / - 0.5 mm (U <sub>RAC</sub> = 160 V) |                                                                                         |                                                                                      |                                  |                                                |                                      |                                      |                                         |                                         |                                        |                                        |                 |             |                |       |
|                                                                                                                         |                                                                                         |                                                                                      | l <sub>t</sub> = 3.5 mm ± 0.5 mm |                                                | l <sub>t</sub> = 24.0 mm<br>± 4.0 mm |                                      | P = 27.5 mm<br>P <sub>0</sub> = 12.7 mm |                                         | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                                        |                 |             |                |       |
| 5.6                                                                                                                     | 15.0 x 28.0 x 30.0                                                                      | 7.5                                                                                  | 16...<br>(300)                   | 17...<br>(300)                                 | 53...<br>(200)                       | 54...<br>(200)                       | -                                       |                                         | -                                      |                                        | 565             |             |                |       |
| 400                                                                                                                     | Pitch = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 220 V) |                                                                                      |                                  |                                                |                                      |                                      |                                         |                                         |                                        |                                        |                 |             |                |       |
|                                                                                                                         |                                                                                         |                                                                                      |                                  | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm / - 0.5 mm |                                      | l <sub>t</sub> = 19.0 mm<br>± 4.0 mm |                                         | P = 15 mm<br>P <sub>0</sub> = 12.7 mm   |                                        | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                 |             |                |       |
|                                                                                                                         | 0.12                                                                                    | 5.0 x 14.0 (15.5) x 17.5                                                             | 0.80                             | 28...<br>(2000)                                | 29...<br>(2000)                      | 55...<br>(1250)                      | 56...<br>(1250)                         | 30...<br>(1200)                         | 31...<br>(1200)                        | 65...<br>(1000)                        | 66...<br>(1000) | 124         |                |       |
|                                                                                                                         | 0.15                                                                                    | 5.8 x 15.0 (16.5) x 17.5                                                             | 0.95                             | 28...<br>(1750)                                | 29...<br>(1750)                      | 55...<br>(1250)                      | 56...<br>(1250)                         | 30...<br>(1100)                         | 31...<br>(1100)                        | 65...<br>(850)                         | 66...<br>(850)  | 154         |                |       |
|                                                                                                                         | 0.18                                                                                    | 6.5 x 15.5 (17.0) x 17.5                                                             | 1.15                             | 28...<br>(1500)                                | 29...<br>(1500)                      | 55...<br>(1000)                      | 56...<br>(1000)                         | 30...<br>(900)                          | 31...<br>(900)                         | 65...<br>(750)                         | 66...<br>(750)  | 184         |                |       |
|                                                                                                                         | 0.22                                                                                    | 7.0 x 16.0 (17.5) x 17.5                                                             | 1.25                             | 28...<br>(1500)                                | 29...<br>(1500)                      | 55...<br>(1000)                      | 56...<br>(1000)                         | 30...<br>(800)                          | 31...<br>(800)                         | 65...<br>(700)                         | 66...<br>(700)  | 224         |                |       |
|                                                                                                                         | 0.27                                                                                    | 7.4 x 16.5 (18.0) x 17.5                                                             | 1.28                             | 28...<br>(1250)                                | 29...<br>(1250)                      | 55...<br>(1250)                      | 56...<br>(1250)                         | 30...<br>(800)                          | 31...<br>(800)                         | 65...<br>(650)                         | 66...<br>(650)  | 274         |                |       |
|                                                                                                                         | 0.33                                                                                    | 8.5 x 17.5 (19.0) x 17.5                                                             | 1.70                             | 28...<br>(1000)                                | 29...<br>(1000)                      | 55...<br>(1000)                      | 56...<br>(1000)                         | 30...<br>(700)                          | 31...<br>(700)                         | 65...<br>(550)                         | 66...<br>(550)  | 334         |                |       |
|                                                                                                                         | 0.39                                                                                    | 7.4 x 19.5 (21.0) x 17.5                                                             | 2.00                             | 28...<br>(1000)                                | 29...<br>(1000)                      | 55...<br>(1000)                      | 56...<br>(1000)                         | 30...<br>(800)                          | 31...<br>(800)                         | 65...<br>(650)                         | 66...<br>(650)  | 394         |                |       |
|                                                                                                                         | 0.47                                                                                    | 8.4 x 20.5 (22.0) x 17.5                                                             | 2.10                             | 28...<br>(750)                                 | 29...<br>(750)                       | 55...<br>(850)                       | 56...<br>(850)                          | 30...<br>(700)                          | 31...<br>(700)                         | 65...<br>(550)                         | 66...<br>(550)  | 474         |                |       |

**ELECTRICAL DATA AND ORDERING INFORMATION: MKT468**

| CATALOG NUMBER BFC2 468 XXYYY AND PACKAGING |                                                                                                                         |                                                                                      |                            |                                              |                   |                                      |                   |                                         |                   |                                        |                   |             |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------|----------------------------------------------|-------------------|--------------------------------------|-------------------|-----------------------------------------|-------------------|----------------------------------------|-------------------|-------------|
| U <sub>RDC</sub><br>(V)                     | CAP.<br>(μF)                                                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h (h') <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup> | LOOSE IN BOX                                 |                   |                                      |                   | REEL<br>H = 16.0 mm                     |                   |                                        |                   | C-<br>VALUE |
|                                             |                                                                                                                         |                                                                                      |                            |                                              |                   |                                      |                   | ORIGINAL PITCH                          |                   | BENT BACK PITCH                        |                   |             |
|                                             |                                                                                                                         |                                                                                      |                            | C-TOL. =<br>± 10 %                           | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                   | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                      | C-TOL. =<br>± 5 % | C-TOL. =<br>± 10 %                     | C-TOL. =<br>± 5 % |             |
|                                             |                                                                                                                         |                                                                                      |                            | XX<br>(SPQ)                                  | XX<br>(SPQ)       | XX<br>(SPQ)                          | XX<br>(SPQ)       | XX<br>(SPQ)                             | XX<br>(SPQ)       | XX<br>(SPQ)                            | XX<br>(SPQ)       |             |
| 400                                         | Pitch = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 220 V)                                 |                                                                                      |                            |                                              |                   |                                      |                   |                                         |                   |                                        |                   |             |
|                                             |                                                                                                                         |                                                                                      |                            | l <sub>t</sub> = 3.5 mm ± 0.5 mm             |                   | l <sub>t</sub> = 25.0 mm<br>± 4.0 mm |                   | P = 22.5 mm<br>P <sub>0</sub> = 12.7 mm |                   | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |
|                                             | 0.56                                                                                                                    | 7.0 x 19.5 x 26.0                                                                    | 2.5                        | 28...<br>(1000)                              | 29...<br>(1000)   | 55...<br>(650)                       | 56...<br>(650)    | -                                       |                   | -                                      |                   | 564         |
|                                             | 0.68                                                                                                                    | 8.0 x 21.0 x 26.0                                                                    | 2.8                        | 28...<br>(750)                               | 29...<br>(750)    | 55...<br>(500)                       | 56...<br>(500)    |                                         |                   |                                        |                   | 684         |
|                                             | 0.82                                                                                                                    | 9.0 x 22.0 x 26.0                                                                    | 3.3                        | 28...<br>(750)                               | 29...<br>(750)    | 55...<br>(500)                       | 56...<br>(500)    |                                         |                   |                                        |                   | 824         |
|                                             | 1.0                                                                                                                     | 9.9 x 23.0 x 26.0                                                                    | 3.5                        | 28...<br>(750)                               | 29...<br>(750)    | 55...<br>(450)                       | 56...<br>(450)    |                                         |                   |                                        |                   | 105         |
|                                             | 1.2                                                                                                                     | 11.0 x 24.0 x 26.0                                                                   | 4.0                        | 28...<br>(500)                               | 29...<br>(500)    | 55...<br>(400)                       | 56...<br>(400)    |                                         |                   |                                        |                   | 125         |
|                                             | Pitch = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; A = 2.5 mm + 1.4 mm / - 0.5 mm (U <sub>RAC</sub> = 220 V) |                                                                                      |                            |                                              |                   |                                      |                   |                                         |                   |                                        |                   |             |
|                                             |                                                                                                                         |                                                                                      |                            | l <sub>t</sub> = 3.5 mm ± 0.5 mm             |                   | l <sub>t</sub> = 24.0 mm<br>± 4.0 mm |                   | P = 27.5 mm<br>P <sub>0</sub> = 12.7 mm |                   | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |
|                                             | 1.5                                                                                                                     | 11.5 x 24.5 x 30.0                                                                   | 5.8                        | 28...<br>(450)                               | 29...<br>(450)    | 55...<br>(300)                       | 56...<br>(300)    | -                                       |                   | -                                      |                   | 155         |
|                                             | 1.8                                                                                                                     | 12.5 x 25.5 x 30.0                                                                   | 6.4                        | 28...<br>(350)                               | 29...<br>(350)    | 55...<br>(250)                       | 56...<br>(250)    |                                         |                   |                                        |                   | 185         |
|                                             | 2.2                                                                                                                     | 14.0 x 27.0 x 30.0                                                                   | 7.3                        | 28...<br>(300)                               | 29...<br>(300)    | 55...<br>(200)                       | 56...<br>(200)    |                                         |                   |                                        |                   | 225         |
| 630                                         | Pitch = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 250 V)                                 |                                                                                      |                            |                                              |                   |                                      |                   |                                         |                   |                                        |                   |             |
|                                             |                                                                                                                         |                                                                                      |                            | l <sub>t</sub> = 3.5 mm<br>+ 1.0 mm/- 0.5 mm |                   | l <sub>t</sub> = 19.0 mm<br>± 4.0 mm |                   | P = 15 mm<br>P <sub>0</sub> = 12.7 mm   |                   | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |
|                                             | 0.039                                                                                                                   | 5.0 x 14.0 (15.5) x 17.5                                                             | 0.80                       | 40...<br>(2000)                              | 41...<br>(2000)   | 57...<br>(1250)                      | 58...<br>(1250)   | 42...<br>(1200)                         | 43...<br>(1200)   | 67...<br>(1000)                        | 68...<br>(1000)   | 393         |
|                                             | 0.047                                                                                                                   | 5.5 x 14.5 (16.0) x 17.5                                                             | 0.90                       | 40...<br>(2000)                              | 41...<br>(2000)   | 57...<br>(1250)                      | 58...<br>(1250)   | 42...<br>(1100)                         | 43...<br>(1100)   | 67...<br>(900)                         | 68...<br>(900)    | 473         |
|                                             | 0.056                                                                                                                   | 5.9 x 15.0 (16.5) x 17.5                                                             | 0.95                       | 40...<br>(1750)                              | 41...<br>(1750)   | 57...<br>(1250)                      | 58...<br>(1250)   | 42...<br>(1000)                         | 43...<br>(1000)   | 67...<br>(850)                         | 68...<br>(850)    | 563         |
|                                             | 0.068                                                                                                                   | 6.5 x 16.0 (17.5) x 17.5                                                             | 1.15                       | 40...<br>(1500)                              | 41...<br>(1500)   | 57...<br>(1000)                      | 58...<br>(1000)   | 42...<br>(800)                          | 43...<br>(800)    | 67...<br>(750)                         | 68...<br>(750)    | 683         |
|                                             | 0.082                                                                                                                   | 7.3 x 16.5 (18.0) x 17.5                                                             | 1.27                       | 40...<br>(1500)                              | 41...<br>(1500)   | 57...<br>(1000)                      | 58...<br>(1000)   | 42...<br>(800)                          | 43...<br>(800)    | 67...<br>(650)                         | 68...<br>(650)    | 823         |
|                                             | 0.10                                                                                                                    | 7.9 x 17.0 (18.5) x 17.5                                                             | 1.48                       | 40...<br>(1250)                              | 41...<br>(1250)   | 57...<br>(1000)                      | 58...<br>(1000)   | 42...<br>(750)                          | 43...<br>(750)    | 67...<br>(600)                         | 68...<br>(600)    | 104         |
|                                             | 0.12                                                                                                                    | 7.5 x 19.5 (21.0) x 17.5                                                             | 2.00                       | 40...<br>(1250)                              | 41...<br>(1250)   | 57...<br>(1000)                      | 58...<br>(1000)   | 42...<br>(800)                          | 43...<br>(800)    | 67...<br>(650)                         | 68...<br>(650)    | 124         |
|                                             | 0.15                                                                                                                    | 8.5 x 20.5 (22.0) x 17.5                                                             | 2.20                       | 40...<br>(1000)                              | 41...<br>(1000)   | 57...<br>(850)                       | 58...<br>(850)    | 42...<br>(700)                          | 43...<br>(700)    | 67...<br>(550)                         | 68...<br>(550)    | 154         |

**ELECTRICAL DATA AND ORDERING INFORMATION: MKT468**

| CATALOG NUMBER BFC2 468 XXYYY AND PACKAGING |                                                                                                                         |                                                                                      |                                     |                                     |                                      |                                      |                                         |                                         |                                        |                                        |                   |             |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------------|-----------------------------------------|----------------------------------------|----------------------------------------|-------------------|-------------|
| U <sub>RDC</sub><br>(V)                     | CAP.<br>(μF)                                                                                                            | DIMENSIONS<br>w <sub>max.</sub> x h (h') <sub>max.</sub> x l <sub>max.</sub><br>(mm) | MASS<br>(g) <sup>(1)</sup>          | LOOSE IN BOX                        |                                      |                                      |                                         | REEL<br>H = 16.0 mm                     |                                        |                                        |                   | C-<br>VALUE |
|                                             |                                                                                                                         |                                                                                      |                                     |                                     |                                      |                                      |                                         | ORIGINAL PITCH                          |                                        | BENT BACK PITCH                        |                   |             |
|                                             |                                                                                                                         |                                                                                      |                                     | C-TOL. =<br>± 10 %                  | C-TOL. =<br>± 5 %                    | C-TOL. =<br>± 10 %                   | C-TOL. =<br>± 5 %                       | C-TOL. =<br>± 10 %                      | C-TOL. =<br>± 5 %                      | C-TOL. =<br>± 10 %                     | C-TOL. =<br>± 5 % |             |
|                                             |                                                                                                                         |                                                                                      |                                     | XX<br>(SPQ)                         | XX<br>(SPQ)                          | XX<br>(SPQ)                          | XX<br>(SPQ)                             | XX<br>(SPQ)                             | XX<br>(SPQ)                            | XX<br>(SPQ)                            | XX<br>(SPQ)       |             |
| 630                                         | Pitch = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm (U <sub>RAC</sub> = 250 V)                                 |                                                                                      |                                     |                                     |                                      |                                      |                                         |                                         |                                        |                                        |                   |             |
|                                             |                                                                                                                         |                                                                                      |                                     | l <sub>t</sub> = 3.5 mm<br>± 0.5 mm |                                      | l <sub>t</sub> = 25.0 mm<br>± 4.0 mm |                                         | P = 22.5 mm<br>P <sub>0</sub> = 12.7 mm |                                        | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                   |             |
|                                             | 0.18                                                                                                                    | 7.5 x 19.5 x 26.0                                                                    | 2.5                                 | 40...<br>(1000)                     | 41...<br>(1000)                      | 57...<br>(650)                       | 58...<br>(650)                          | -                                       |                                        | -                                      |                   | 184         |
|                                             | 0.22                                                                                                                    | 8.0 x 21.0 x 26.0                                                                    | 2.8                                 | 40...<br>(750)                      | 41...<br>(750)                       | 57...<br>(500)                       | 58...<br>(500)                          |                                         |                                        |                                        |                   | 224         |
|                                             | 0.27                                                                                                                    | 9.0 x 22.0 x 26.0                                                                    | 3.3                                 | 40...<br>(750)                      | 41...<br>(750)                       | 57...<br>(500)                       | 58...<br>(500)                          |                                         |                                        |                                        |                   | 274         |
|                                             | 0.33                                                                                                                    | 10.0 x 23.0 x 26.0                                                                   | 3.5                                 | 40...<br>(700)                      | 41...<br>(700)                       | 57...<br>(450)                       | 58...<br>(450)                          |                                         |                                        |                                        |                   | 334         |
|                                             | 0.39                                                                                                                    | 11.5 x 24.0 x 26.0                                                                   | 4.2                                 | 40...<br>(600)                      | 41...<br>(600)                       | 57...<br>(400)                       | 58...<br>(400)                          |                                         |                                        |                                        |                   | 394         |
|                                             | 0.47                                                                                                                    | 12.5 x 25.5 x 26.0                                                                   | 4.5                                 | 40...<br>(500)                      | 41...<br>(500)                       | 57...<br>(300)                       | 58...<br>(300)                          |                                         |                                        |                                        |                   | 474         |
|                                             | 0.56                                                                                                                    | 13.5 x 26.6 x 26.0                                                                   | 5.5                                 | 40...<br>(450)                      | 41...<br>(450)                       | 57...<br>(300)                       | 58...<br>(300)                          |                                         |                                        |                                        |                   | 564         |
|                                             | 0.68                                                                                                                    | 15.0 x 28.0 x 26.0                                                                   | 6.5                                 | 40...<br>(400)                      | 41...<br>(400)                       | 57...<br>(250)                       | 58...<br>(250)                          |                                         |                                        |                                        |                   | 684         |
|                                             | Pitch = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; A = 2.5 mm + 1.4 mm / - 0.5 mm (U <sub>RAC</sub> = 250 V) |                                                                                      |                                     |                                     |                                      |                                      |                                         |                                         |                                        |                                        |                   |             |
|                                             |                                                                                                                         |                                                                                      | l <sub>t</sub> = 3.5 mm<br>± 0.5 mm |                                     | l <sub>t</sub> = 24.0 mm<br>± 4.0 mm |                                      | P = 27.5 mm<br>P <sub>0</sub> = 12.7 mm |                                         | P = 7.5 mm<br>P <sub>0</sub> = 15.0 mm |                                        |                   |             |
| 0.82                                        | 15.0 x 28.0 x 30.0                                                                                                      | 7.5                                                                                  | 40...<br>(300)                      | 41...<br>(300)                      | 57...<br>(200)                       | 58...<br>(200)                       | -                                       |                                         | -                                      |                                        | -                 |             |

**Notes**

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

**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](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 ensured that the underside and the kinks 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

**Storage Temperature**

T<sub>stg</sub> = -25 °C to +35 °C with RH maximum 75 % without condensation

**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](http://www.vishay.com/doc?28171)

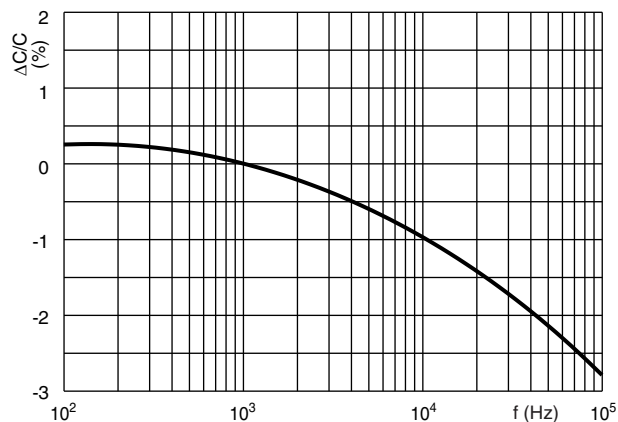
**Ratings and Characteristics Reference Conditions**

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

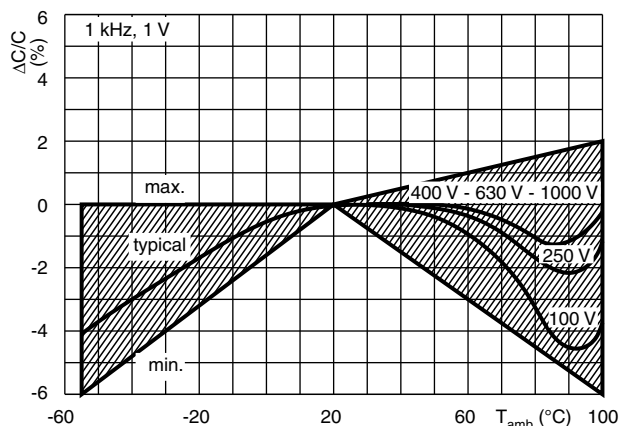
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.



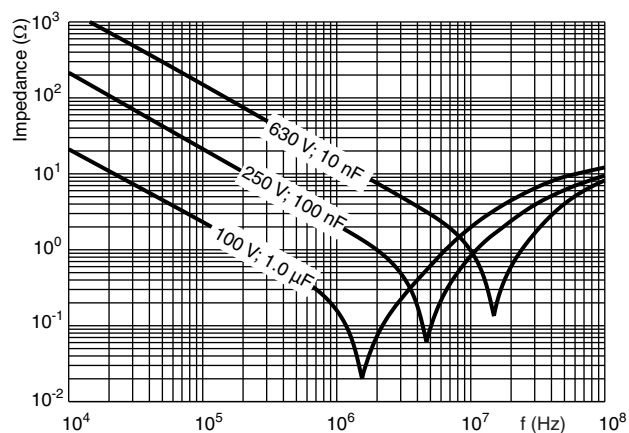
## CHARACTERISTICS



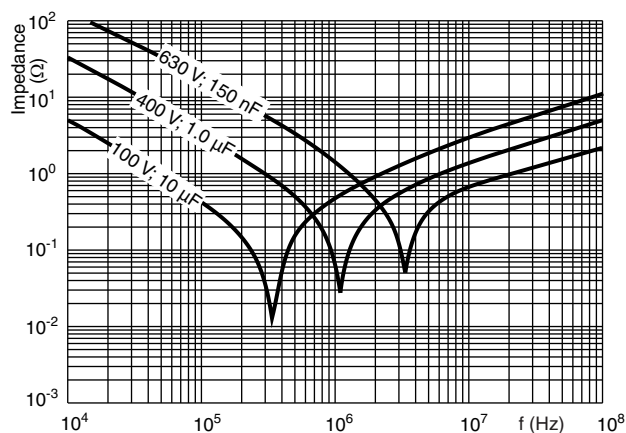
Capacitance as a function of frequency  
(typical curve)



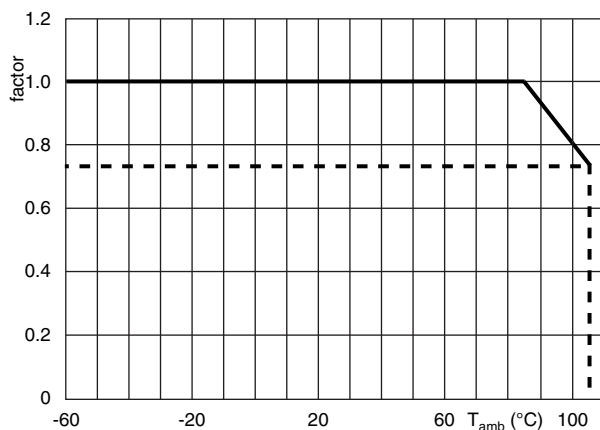
Capacitance as a function of ambient temperature  
(typical curve)



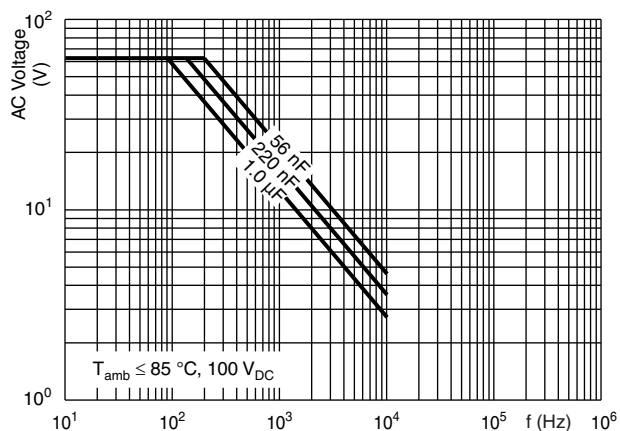
MKT467 - Impedance as a function of frequency  
(typical curve)



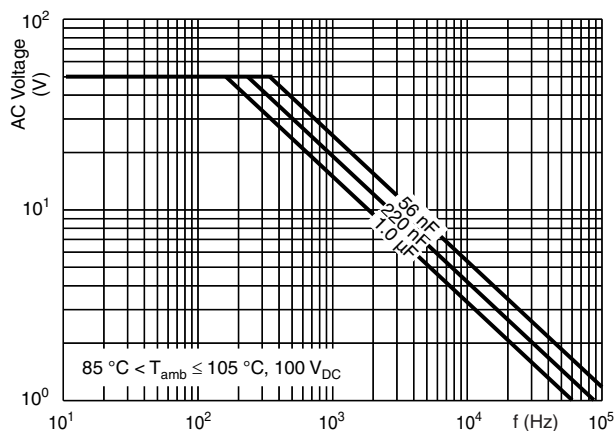
MKT468 - Impedance as a function of frequency  
(typical curve)



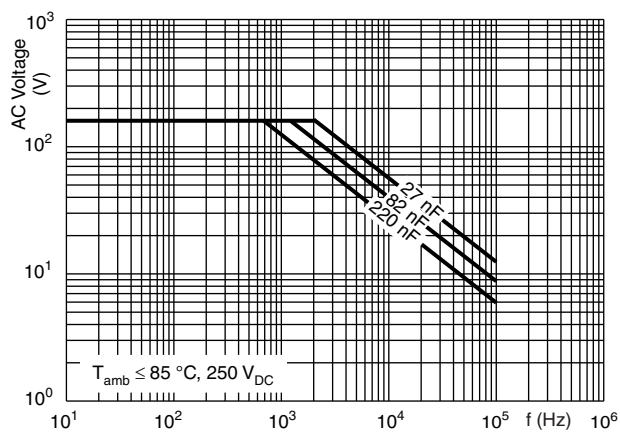
Max. DC and AC voltage as a function of temperature



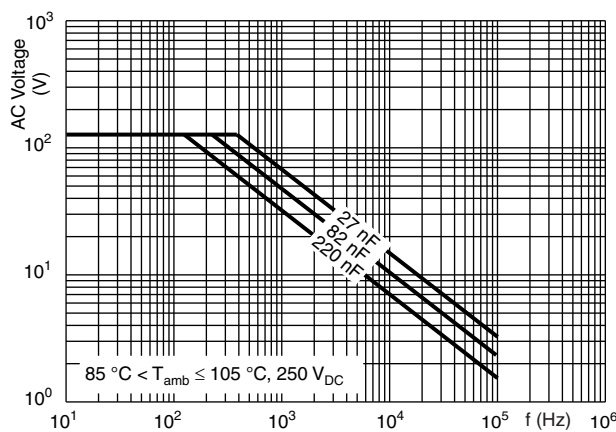
MKT467 - Max. RMS voltage as a function of frequency



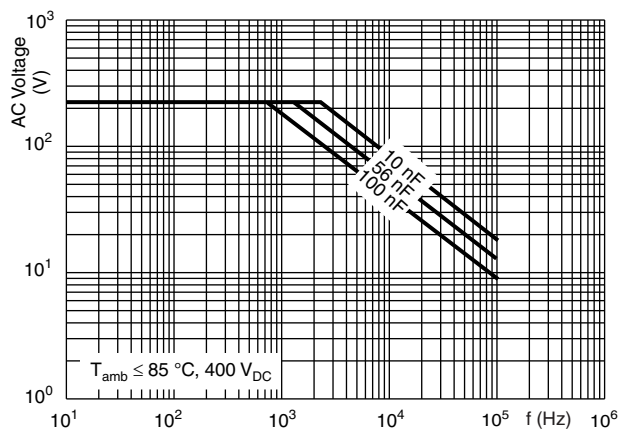
MKT467 - Max. RMS voltage as a function of frequency



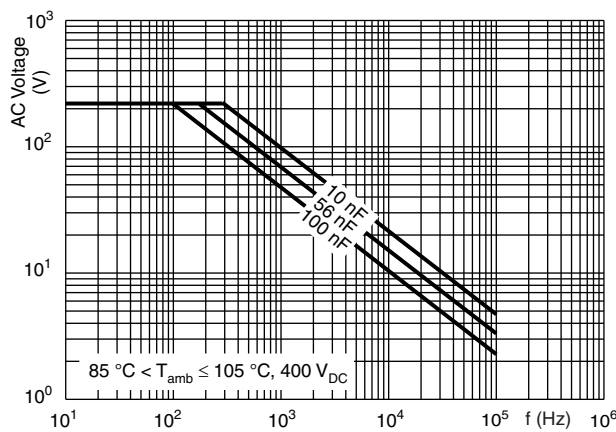
MKT467 - Max. RMS voltage as a function of frequency



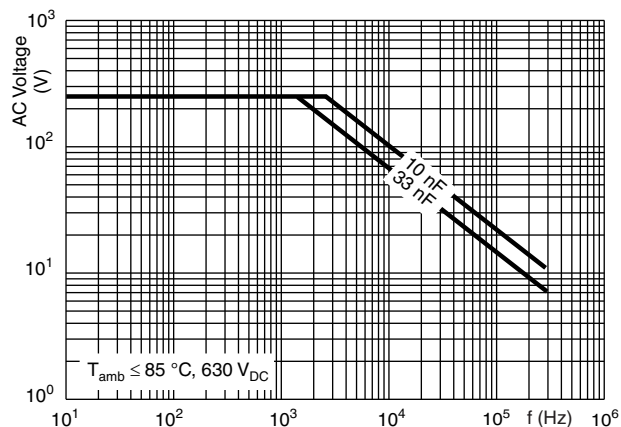
MKT467 - Max. RMS voltage as a function of frequency



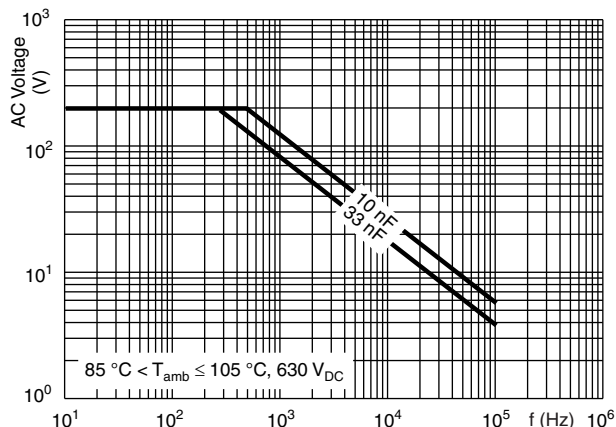
MKT467 - Max. RMS voltage as a function of frequency



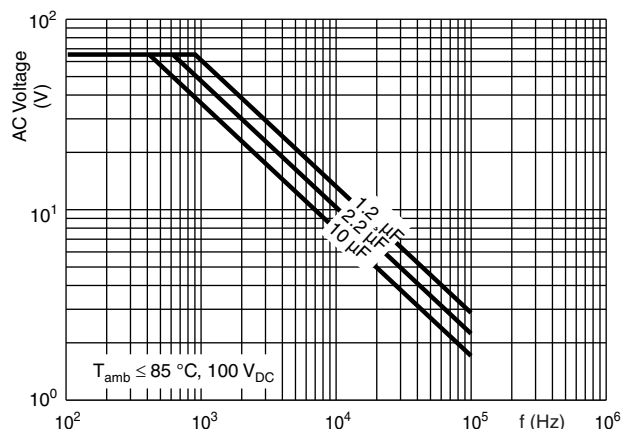
MKT467 - Max. RMS voltage as a function of frequency



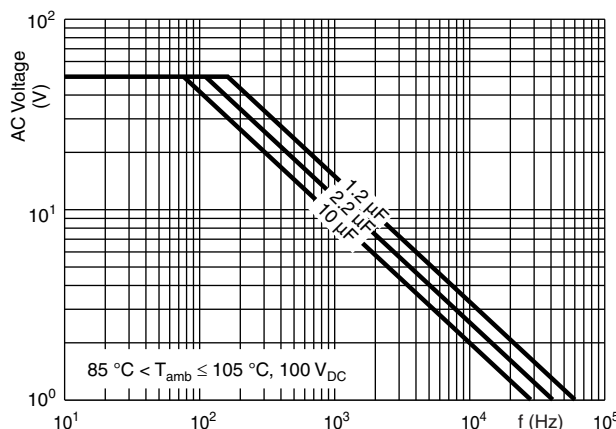
MKT467 - Max. RMS voltage as a function of frequency



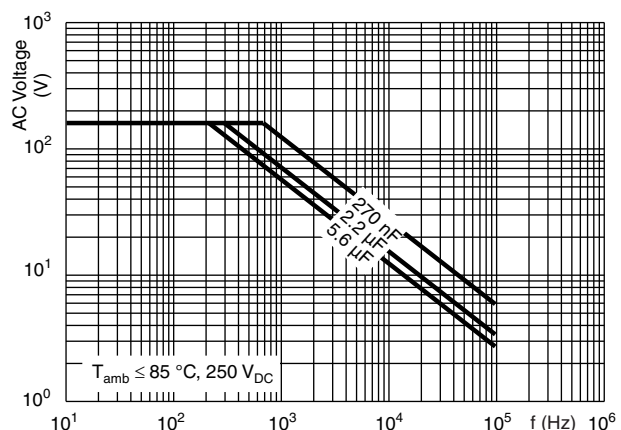
MKT467 - Max. RMS voltage as a function of frequency



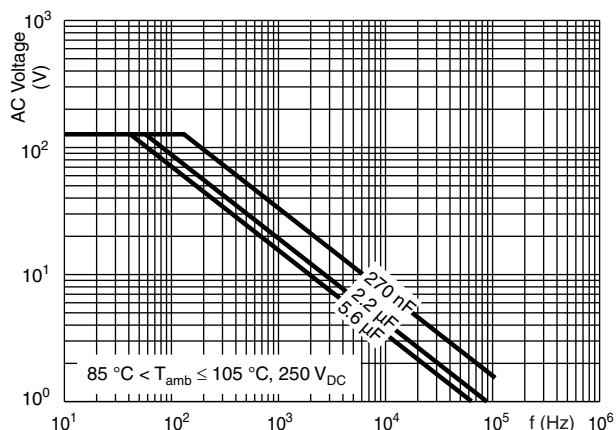
MKT468 - Max. RMS voltage as a function of frequency



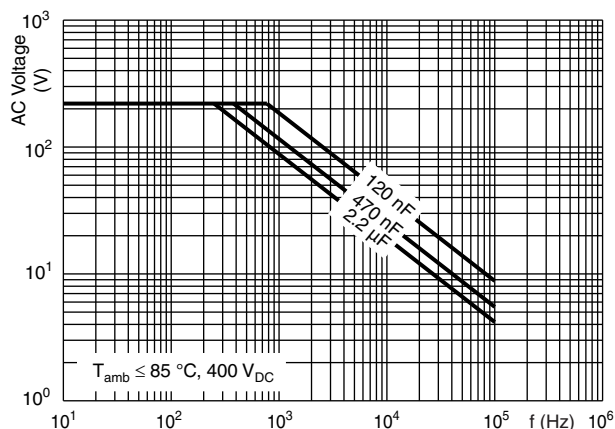
MKT468 - Max. RMS voltage as a function of frequency



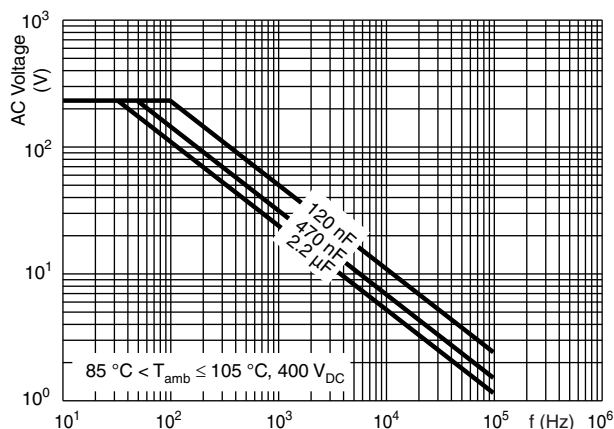
MKT468 - Max. RMS voltage as a function of frequency



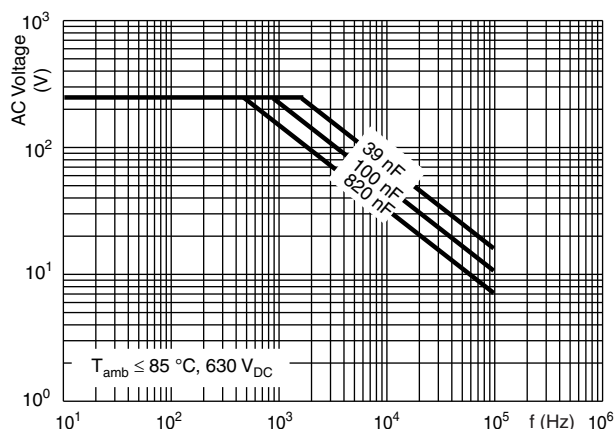
MKT468 - Max. RMS voltage as a function of frequency



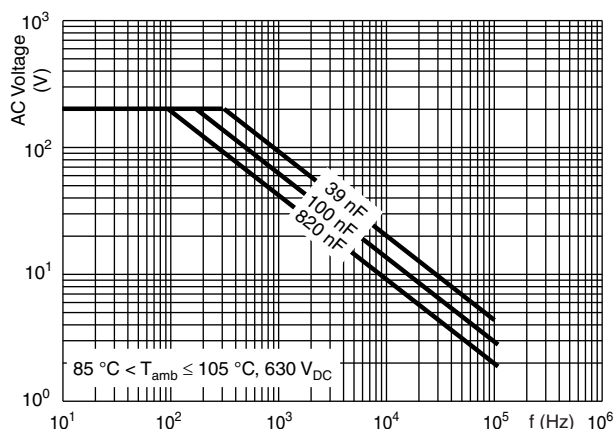
MKT468 - Max. RMS voltage as a function of frequency



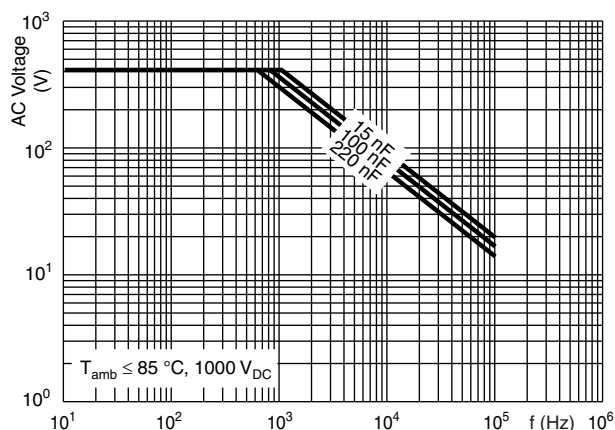
MKT468 - Max. RMS voltage as a function of frequency



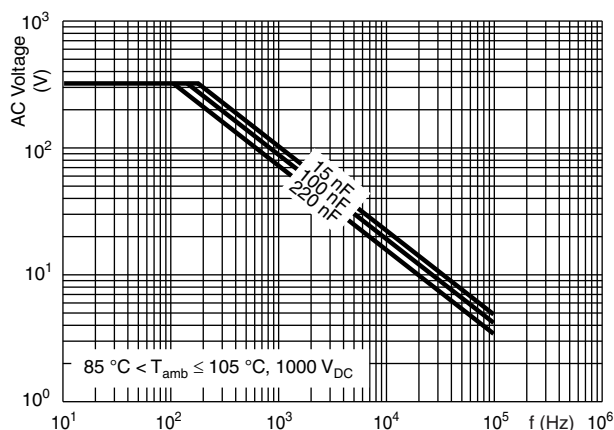
MKT468 - Max. RMS voltage as a function of frequency



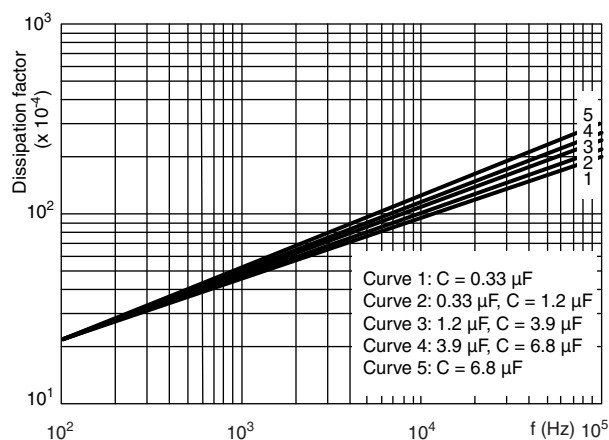
MKT468 - Max. RMS voltage as a function of frequency



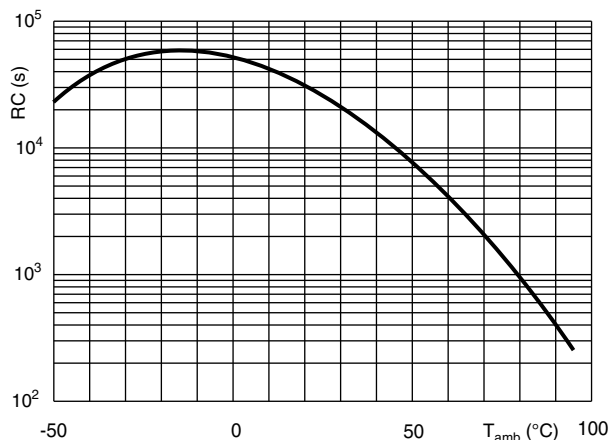
MKT468 - Max. RMS voltage as a function of frequency



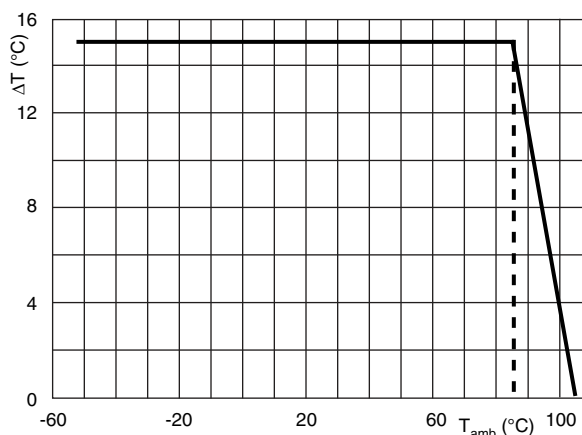
MKT468 - Max. RMS voltage as a function of frequency



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



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



Maximum allowed component temperature rise ( $\Delta T$ ) as a function of the ambient temperature ( $T_{amb}$ )

**HEAT CONDUCTIVITY (G) AS A FUNCTION OF (ORIGINAL) PITCH AND CAPACITOR BODY THICKNESS IN mW/°C**

| W <sub>max.</sub><br>(mm) | HEAT CONDUCTIVITY (mW/°C) |               |               |               |
|---------------------------|---------------------------|---------------|---------------|---------------|
|                           | PITCH 10 mm               | PITCH 15.5 mm | PITCH 22.5 mm | PITCH 27.5 mm |
| 4.0                       | 4.0                       | 5.0           | -             | -             |
| 4.5                       | 4.5                       | 6.0           | -             | -             |
| 5.0                       | 5.0                       | 6.0           | 12.0          | 13.0          |
| 5.5                       | 6.0                       | 6.5           | 13.0          | 15.0          |
| 6.0                       | 6.0                       | 6.5           | 13.0          | 15.0          |
| 6.5                       | 6.5                       | 8.0           | 15.0          | 17.0          |
| 7.0                       | -                         | 8.0           | 15.0          | 17.0          |
| 7.5                       | -                         | 9.0           | 17.0          | 18.0          |
| 8.0                       | -                         | 9.0           | 17.0          | 20.0          |
| 8.5                       | -                         | 11.0          | 18.0          | 20.0          |
| 9.0                       | -                         | 11.0          | 18.0          | 22.0          |
| 9.5                       | -                         | 12.0          | 20.0          | 22.0          |
| 10.0                      | -                         | 12.0          | 20.0          | 23.0          |
| 10.5                      | -                         | -             | 22.0          | 25.0          |
| 11.0                      | -                         | -             | -             | 25.0          |

**HEAT CONDUCTIVITY (G) AS A FUNCTION OF (ORIGINAL) PITCH AND CAPACITOR BODY THICKNESS IN mW/°C**

| $W_{max.}$<br>(mm) | HEAT CONDUCTIVITY (mW/°C) |               |               |               |
|--------------------|---------------------------|---------------|---------------|---------------|
|                    | PITCH 10 mm               | PITCH 15.5 mm | PITCH 22.5 mm | PITCH 27.5 mm |
| 11.5               | -                         | -             | -             | 27.0          |
| 12.0               | -                         | -             | -             | 27.0          |
| 12.5               | -                         | -             | -             | 30.0          |
| 13.0               | -                         | -             | -             | 30.0          |
| 13.5               | -                         | -             | -             | 30.0          |
| 14.0               | -                         | -             | -             | 30.0          |
| 14.5               | -                         | -             | -             | 33.0          |
| 15.0               | -                         | -             | -             | 33.0          |
| 15.5               | -                         | -             | -             | 37.0          |
| 16.0               | -                         | -             | -             | 37.0          |

**POWER DISSIPATION AND MAXIMUM COMPONENT TEMPERATURE RISE**

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

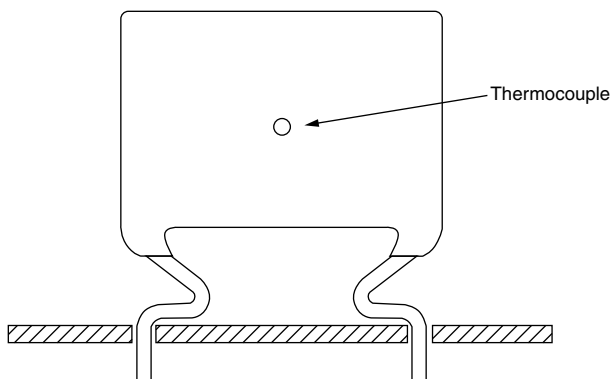
The power dissipation can be calculated according type detail specification "HQN-384-01/101: Technical Information Film Capacitors".

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

- $\Delta T$  = component temperature rise (°C)
- P = power dissipation of the component (mW)
- G = heat conductivity of the component (mW/°C)

**MEASURING THE COMPONENT TEMPERATURE**

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



The temperature is measured in unloaded ( $T_{amb}$ ) and maximum loaded condition ( $T_C$ ).

The temperature rise is given by  $\Delta T = T_C - T_{amb}$ .

To avoid radiation or convection, the capacitor should be tested in a wind-free box.

**APPLICATION NOTE AND LIMITING CONDITIONS**

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

For capacitors connected in parallel, normally the proof voltage and possibly the rated voltage must be reduced. For information depending of the capacitance value and the number of parallel connections contact: [dc-film@vishay.com](mailto:dc-film@vishay.com)

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

1. The peak voltage ( $U_P$ ) shall not be greater than the rated DC voltage ( $U_{RDC}$ )
2. The peak-to-peak voltage ( $U_{P-P}$ ) shall not be greater than  $2\sqrt{2} \times U_{RAC}$  to avoid the ionization inception level

3. The voltage pulse slope ( $dU/dt$ ) shall not exceed the rated voltage pulse slope in an RC-circuit at rated voltage and without ringing. If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by  $U_{RDC}$  and divided by the applied voltage.

For all other pulses following equation must be fulfilled:

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

T is the pulse duration.

The rated voltage pulse slope is valid for ambient temperatures up to 85 °C. For higher temperatures a derating factor of 3 % per K shall be applied.

4. The maximum component surface temperature rise must be lower than the limits (see graph “Max. allowed component temperature rise”).
5. Since in circuits used at voltages over 280 V peak-to-peak the risk for an intrinsically active flammability after a capacitor breakdown (short circuit) increases, it is recommended that the power to the component is limited to 100 times the values mentioned in the table: “Heat Conductivity”
6. When using these capacitors as across-the-line capacitor in the input filter for mains applications or as series connected with an impedance to the mains the applicant must guarantee that the following conditions are fulfilled in any case (spikes and surge voltages from the mains included).

#### VOLTAGE CONDITIONS FOR 6 ABOVE

| ALLOWED VOLTAGES                             | $T_{amb} \leq 85\text{ °C}$ | $85\text{ °C} < T_{amb} \leq 105\text{ °C}$ |
|----------------------------------------------|-----------------------------|---------------------------------------------|
| Maximum continuous RMS voltage               | $U_{RAC}$                   | $0.8 \times U_{RAC}$                        |
| Maximum temperature RMS-overvoltage (< 24 h) | $1.25 \times U_{RAC}$       | $U_{RAC}$                                   |
| Maximum peak voltage ( $V_{O-P}$ ) (< 2 s)   | $1.6 \times U_{RAC}$        | $1.3 \times U_{RAC}$                        |

#### Example

C = 330 nF - 100 V used for the voltage signal shown in next drawing.

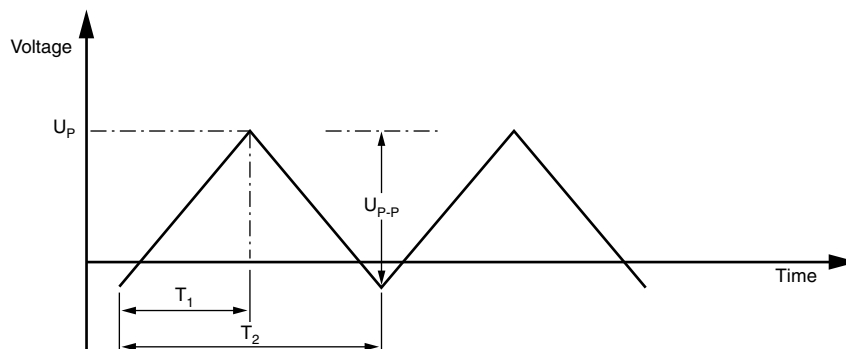
$U_{P-P} = 80\text{ V}$ ;  $U_P = 70\text{ V}$ ;  $T_1 = 0.5\text{ ms}$ ;  $T_2 = 1\text{ ms}$

The ambient temperature is 35 °C

Checking conditions:

1. The peak voltage  $U_P = 70\text{ V}$  is lower than  $100\text{ V}_{DC}$
2. The peak-to-peak voltage  $80\text{ V}$  is lower than  $2\sqrt{2} \times 63\text{ V}_{AC} = 178\text{ V}_{P-P}$
3. The voltage pulse slope ( $dU/dt$ ) =  $80\text{ V}/500\text{ }\mu\text{s} = 0.16\text{ V}/\mu\text{s}$   
This is lower than  $20\text{ V}/\mu\text{s}$  (see specific reference data for each version)
4. The dissipated power is 60 mW as calculated with fourier terms  
The temperature rise for  $W_{max.} = 8.5\text{ mm}$  and pitch = 15 mm will be  $60\text{ mW}/11\text{ mW}/\text{°C} = 5.5\text{ °C}$   
This is lower than 15 °C temperature rise at 35 °C, according figure “Max. allowed component temperature rise”
5. Not applicable
6. Not applicable

#### Voltage Signal



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

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

| <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                                                                                                                                                                                                                                  |
| 4.3.1 Initial measurements                          | Capacitance<br>Tangent of loss angle:<br>for $C \leq 470 \text{ nF}$ at 100 kHz or<br>for $C > 470 \text{ nF}$ at 10 kHz                                                                                                                           |                                                                                                                                                                                                                                                                                                |
| 4.3 Robustness of terminations                      | Tensile: load 10 N; 10 s<br>Bending: load 5 N; $4 \times 90^\circ$                                                                                                                                                                                 | No visible damage                                                                                                                                                                                                                                                                              |
| 4.4 Resistance to soldering heat                    | Method: 1A<br>Solder bath: $280^\circ\text{C} \pm 5^\circ\text{C}$<br>Duration: 10 s                                                                                                                                                               |                                                                                                                                                                                                                                                                                                |
| 4.14 Component solvent resistance                   | Isopropylalcohol at room temperature<br>Method: 2<br>Immersion time: 5 min $\pm$ 0.5 min<br>Recovery time: min. 1 h, max. 2 h                                                                                                                      |                                                                                                                                                                                                                                                                                                |
| 4.4.2 Final measurements                            | Visual examination                                                                                                                                                                                                                                 | No visible damage<br>Legible marking                                                                                                                                                                                                                                                           |
|                                                     | Capacitance                                                                                                                                                                                                                                        | $ \Delta C/C  \leq 2\%$ of the value measured initially                                                                                                                                                                                                                                        |
|                                                     | Tangent of loss angle                                                                                                                                                                                                                              | Increase of $\tan \delta$<br>$\leq 0.005$ for: $C \leq 100 \text{ nF}$ or<br>$\leq 0.010$ for: $100 \text{ nF} < C \leq 220 \text{ nF}$ or<br>$\leq 0.015$ for: $220 \text{ nF} < C \leq 470 \text{ nF}$ and<br>$\leq 0.003$ for: $C > 470 \text{ nF}$<br>Compared to values measured in 4.3.1 |
| <b>SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1</b> |                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                |
| 4.6.1 Initial measurements                          | Capacitance<br>Tangent of loss angle:<br>for $C \leq 470 \text{ nF}$ at 100 kHz or<br>for $C > 470 \text{ nF}$ at 10 kHz                                                                                                                           | No visible damage                                                                                                                                                                                                                                                                              |
| 4.6 Rapid change of temperature                     | $\theta A = -55^\circ\text{C}$<br>$\theta B = +100^\circ\text{C}$<br>5 cycles<br>Duration $t = 30 \text{ min}$                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| 4.7 Vibration                                       | Visual examination<br>Mounting:<br>see section “Mounting” of this specification<br>Procedure B4<br>Frequency range: 10 Hz to 55 Hz<br>Amplitude: 0.75 mm or<br>Acceleration $98 \text{ m/s}^2$<br>(whichever is less severe)<br>Total duration 6 h | No visible damage                                                                                                                                                                                                                                                                              |
| 4.7.2 Final inspection                              | Visual examination                                                                                                                                                                                                                                 | No visible damage                                                                                                                                                                                                                                                                              |



| <b>GROUP C INSPECTION REQUIREMENTS</b>                                     |                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SUB-CLAUSE NUMBER AND TEST</b>                                          | <b>CONDITIONS</b>                                                                                                                                                                        | <b>PERFORMANCE REQUIREMENTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.9 Shock                                                                  | Mounting:<br>see section "Mounting" of this specification<br>Pulse shape: half sine<br>Acceleration: 490 m/s <sup>2</sup><br>Duration of pulse: 11 ms                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.9.3 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 3\%$ of the value measured in 4.6.1<br><br>Increase of $\tan \delta$<br>$\leq 0.005$ for: $C \leq 100$ nF or<br>$\leq 0.010$ for: $100$ nF $< C \leq 220$ nF or<br>$\leq 0.015$ for: $220$ nF $< C \leq 470$ nF and<br>$\leq 0.003$ for: $C > 470$ nF<br>Compared to values measured in 4.6.1<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> |                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.10 Climatic sequence                                                     |                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.10.2 Dry heat                                                            | Temperature: +105 °C<br>Duration: 16 h                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.10.3 Damp heat cyclic<br>Test Db, first cycle                            |                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.10.4 Cold                                                                | Temperature: -55 °C<br>Duration: 2 h                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.10.6 Damp heat cyclic<br>Test Db, remaining cycles                       |                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.10.6.2 Final measurements                                                | Voltage proof = $U_{RDC}$ for 1 min within 15 min after removal from test chamber<br><br>Visual examination<br><br>Capacitance<br><br>Tangent of loss angle<br><br>Insulation resistance | No breakdown or flash-over<br><br>No visible damage<br>Legible marking<br><br>$ \Delta C/C  \leq 5\%$ of the value measured in 4.4.2 or 4.9.3<br><br>Increase of $\tan \delta$<br>$\leq 0.007$ for: $C \leq 100$ nF or<br>$\leq 0.010$ for: $100$ nF $< C \leq 220$ nF or<br>$\leq 0.015$ for: $220$ nF $< C \leq 470$ nF and<br>$\leq 0.005$ for: $C > 470$ nF<br>Compared to values measured in 4.3.1 or 4.6.1<br><br>$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification |



| <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>                    |                                                                                                                   |                                                                                                                                                                                                                                                     |
| 4.11 Damp heat steady state            | 56 days, 40 °C, 90 % to 95 % RH                                                                                   |                                                                                                                                                                                                                                                     |
| 4.11.1 Initial measurements            | Capacitance<br>Tangent of loss angle at 1 kHz                                                                     |                                                                                                                                                                                                                                                     |
| 4.11.3 Final measurements              | Voltage proof = $U_{RDC}$ for 1 min within 15 min after removal from test chamber                                 | No breakdown or flash-over                                                                                                                                                                                                                          |
|                                        | 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 $\tan \delta \leq 0.005$<br>Compared to values measured in 4.11.1                                                                                                                                                                       |
|                                        | Insulation resistance                                                                                             | $\geq 50\%$ of values specified in section "Insulation Resistance" of this specification                                                                                                                                                            |
| <b>SUB-GROUP C3</b>                    |                                                                                                                   |                                                                                                                                                                                                                                                     |
| 4.12 Endurance                         | Duration: 2000 h<br>$1.25 \times U_{RDC}$ at 85 °C<br>$1.0 \times U_{RDC}$ at 105 °C                              |                                                                                                                                                                                                                                                     |
| 4.12.1 Initial measurements            | Capacitance<br>Tangent of loss angle:<br>for $C \leq 470$ nF at 100 kHz or<br>for $C > 470$ nF at 10 kHz          |                                                                                                                                                                                                                                                     |
| 4.12.5 Final measurements              | Visual examination                                                                                                | No visible damage<br>Legible marking                                                                                                                                                                                                                |
|                                        | Capacitance                                                                                                       | $ \Delta C/C  \leq 5\%$ compared to values measured in 4.12.1                                                                                                                                                                                       |
|                                        | Tangent of loss angle                                                                                             | Increase of $\tan \delta$<br>$\leq 0.005$ for: $C \leq 100$ nF or<br>$\leq 0.010$ for: $100$ nF $< C \leq 220$ nF or<br>$\leq 0.015$ for: $220$ nF $< C \leq 470$ nF and<br>$\leq 0.003$ for: $C > 470$ nF<br>Compared to values measured in 4.12.1 |
|                                        | Insulation resistance                                                                                             | $\geq 50\%$ of values specified in section "Insulation Resistance" of this specification                                                                                                                                                            |
| <b>SUB-GROUP C4</b>                    |                                                                                                                   |                                                                                                                                                                                                                                                     |
| 4.13 Charge and discharge              | 10 000 cycles<br>Charged to $U_{RDC}$<br>Discharge resistance:<br>$R = \frac{U_R}{C \times 2.5 \times (dU/dt)_R}$ |                                                                                                                                                                                                                                                     |
| 4.13.1 Initial measurements            | Capacitance<br>Tangent of loss angle:<br>for $C \leq 470$ nF at 100 kHz or<br>for $C > 470$ nF at 10 kHz          |                                                                                                                                                                                                                                                     |
| 4.13.3 Final measurements              | Capacitance                                                                                                       | $ \Delta C/C  \leq 3\%$ compared to values measured in 4.13.1                                                                                                                                                                                       |
|                                        | Tangent of loss angle                                                                                             | Increase of $\tan \delta$<br>$\leq 0.005$ for: $C \leq 100$ nF or<br>$\leq 0.010$ for: $100$ nF $< C \leq 220$ nF or<br>$\leq 0.015$ for: $220$ nF $< C \leq 470$ nF and<br>$\leq 0.003$ for: $C > 470$ nF<br>Compared to values measured in 4.13.1 |
|                                        | Insulation resistance                                                                                             | $\geq 50\%$ of values specified in section "Insulation Resistance" of this specification                                                                                                                                                            |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.