



## Tantalum Chip Capacitors

Standard / HighCap

**Series/Type:** B45196E, B45198E,  
B45196H, B45198H

**Date:** July 2006



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## Construction

- Polar tantalum capacitors with solid electrolyte
- Conventional TaMnO<sub>2</sub> technology
- Flame-retardant plastic case (UL 94 V-0)
- Optionally tinned or gold-plated terminals



## Features

- Ultra-high volumetric efficiency
- Excellent solderability
- Stable temperature and frequency characteristics
- Low leakage current, low dissipation factor
- Low self-inductance
- High resistance to shock and vibration
- Suitable for use without series resistor (special operating conditions recommended)
- Lead-free and material content compatible with RoHS
- Some partnumbers are only available in M ( $\pm 20\%$ ) tolerance; these types have a maximum capacitance drift at +125 °C of +20%

## Applications

- Telecommunications (e.g. mobile phones, infrastructure)
- Data processing (e.g. laptops, mainframes)
- Measuring and control engineering (e.g. voltage regulators)
- Automotive electronics (e.g. safety applications e.g. airbags, ABS, motor management)
- Medical engineering
- DC/DC converters

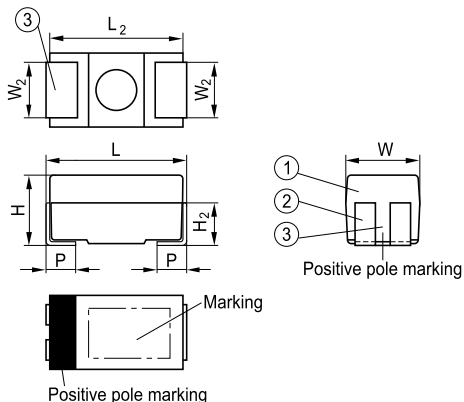
## Soldering

Suitable for reflow soldering (IR and vapor phase, in compliance with JEDEC J-STD-020 C) and wave soldering

## Delivery mode

Taped and reeled in accordance with IEC 60286-3

## Dimensional drawing



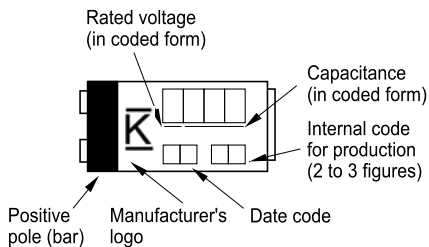
- ① Encapsulation: molded epoxy resin
- ② NiFe; tinned surface Sn100 or gold-plated
- ③ Reduced slot length for case size A

## Dimensions

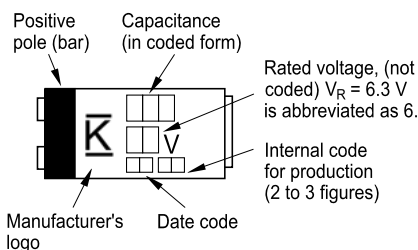
| Case size |          | Dimensions in mm (inches)    |                              |                              |                     |                                |                     |                   |
|-----------|----------|------------------------------|------------------------------|------------------------------|---------------------|--------------------------------|---------------------|-------------------|
| KEMET     | EIA/IECQ | L                            | W                            | H                            | L <sub>2</sub> typ. | W <sub>2</sub> ±0.1<br>±(.004) | H <sub>2</sub> typ. | P ±0.3<br>±(.012) |
| A         | 3216-18  | 3.2 ±0.2<br>(.126<br>±0.008) | 1.6 ±0.2<br>(.063<br>±0.008) | 1.6 ±0.2<br>(.063<br>±0.008) | 3.2<br>(.126)       | 1.2<br>(.047)                  | 1.3<br>(.051)       | 0.8<br>(.031)     |
| B         | 3528-21  | 3.5 ±0.2<br>(.138<br>±0.008) | 2.8 ±0.2<br>(.110<br>±0.008) | 1.9 ±0.2<br>(.075<br>±0.008) | 3.5<br>(.138)       | 2.2<br>(.087)                  | 1.4<br>(.055)       | 0.7<br>(.027)     |
| C         | 6032-28  | 6.0 ±0.3<br>(.236<br>±0.012) | 3.2 ±0.3<br>(.126<br>±0.012) | 2.5 ±0.3<br>(.098<br>±0.012) | 6.1<br>(.240)       | 2.2<br>(.087)                  | 1.8<br>(.071)       | 1.3<br>(.051)     |
| D         | 7343-31  | 7.3 ±0.3<br>(.287<br>±0.012) | 4.3 ±0.3<br>(.169<br>±0.012) | 2.8 ±0.3<br>(.110<br>±0.012) | 7.3<br>(.287)       | 2.4<br>(.094)                  | 1.8<br>(.071)       | 1.3<br>(.051)     |
| E         | 7343-44  | 7.3 ±0.3<br>(.287<br>±0.012) | 4.3 ±0.3<br>(.169<br>±0.012) | 4.1 ±0.3<br>(.161<br>±0.012) | 7.3<br>(.287)       | 2.4<br>(.094)                  | 1.8<br>(.071)       | 1.3<br>(.051)     |

## Marking

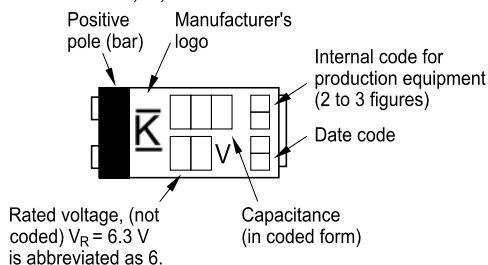
### Case size A



### Case size B



### Case sizes C, D, E



### Voltage coding for case size A

| Rated voltage | 4 | 6.3 | 10 | 16 | 20 | 25 | 35 | 50 |
|---------------|---|-----|----|----|----|----|----|----|
| Code letter   | G | J   | A  | C  | D  | E  | V  | T  |

### Capacitance coding

| 1st and 2nd digit | Capacitance in pF |                                                                      |
|-------------------|-------------------|----------------------------------------------------------------------|
| 3rd digit         | Multiplier:       | $6 = 10^6\text{ pF}$<br>$7 = 10^7\text{ pF}$<br>$8 = 10^8\text{ pF}$ |

### Date coding

| Year     | Month        |               |
|----------|--------------|---------------|
| S = 2004 | 1 = January  | 7 = July      |
| T = 2005 | 2 = February | 8 = August    |
| U = 2006 | 3 = March    | 9 = September |
| V = 2007 | 4 = April    | O = October   |
| W = 2008 | 5 = May      | N = November  |
| X = 2009 | 6 = June     | D = December  |

# Specifications and characteristics for Standard series in brief

|                                                                                                                                                                                                                 |                   |                     |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------|---------------------|
| Series                                                                                                                                                                                                          |                   | Standard            |                     |
| Ordering code                                                                                                                                                                                                   |                   | B45196E             | B45198E             |
| Technology                                                                                                                                                                                                      |                   | Ta-MnO <sub>2</sub> | Ta-MnO <sub>2</sub> |
| Terminals                                                                                                                                                                                                       |                   | Tinned              | Gold-plated         |
| Rated voltage (up to 85 °C)                                                                                                                                                                                     | V <sub>R</sub>    | 4 ... 50            | VDC                 |
| Rated capacitance (20 °C, 120 Hz)                                                                                                                                                                               | C <sub>R</sub>    | 0.10 ... 100        | μF                  |
| Capacitance tolerance                                                                                                                                                                                           |                   | ±20%, ±10%          |                     |
| Maximum impedance (20 °C, 100 kHz)                                                                                                                                                                              | Z <sub>max</sub>  | 0.8 ... 28          | Ω                   |
| Operating temperature range                                                                                                                                                                                     | T <sub>op</sub>   | −55 ... +125        | °C                  |
| Failure rate (at 40 °C; ≤ V <sub>R</sub> , R <sub>S</sub> ≥ 3 Ω/V)<br>(1 fit = 1 · 10 <sup>−9</sup> failures/h)<br>C <sub>R</sub> · V <sub>R</sub> ≤ 330 μF · V<br>C <sub>R</sub> · V <sub>R</sub> > 330 μF · V |                   | ≤3<br>≤10           | fit                 |
| Service life                                                                                                                                                                                                    |                   | >500000             | h                   |
| Leakage current (V <sub>R</sub> , 5 min, 20 °C)                                                                                                                                                                 | I <sub>leak</sub> | 10                  | nA/μC               |
| Detail specification                                                                                                                                                                                            |                   | CECC 30801-801      |                     |
| Climatic category (−55 °C/+125 °C/56 days damp heat test)<br>(to IEC 60068-1)                                                                                                                                   |                   | 55/125/56           |                     |

## Specifications and characteristics for HighCap series in brief

|                                                                                                                                                                                      |            |                     |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------|---------------------|
| Series                                                                                                                                                                               |            | HighCap             |                     |
| Ordering code                                                                                                                                                                        |            | B45196H             | B45198H             |
| Technology                                                                                                                                                                           |            | Ta-MnO <sub>2</sub> | Ta-MnO <sub>2</sub> |
| Terminals                                                                                                                                                                            |            | Tinned              | Gold-plated         |
| Rated voltage (up to 85 °C)                                                                                                                                                          | $V_R$      | 4 ... 50            | VDC                 |
| Rated capacitance (20 °C, 120 Hz)                                                                                                                                                    | $C_R$      | 0.15 ... 1500       | μF                  |
| Capacitance tolerance                                                                                                                                                                |            | ±20%, ±10%          |                     |
| Maximum impedance (20 °C, 100 kHz)                                                                                                                                                   | $Z_{max}$  | 0.4 ... 22          | Ω                   |
| Operating temperature range                                                                                                                                                          | $T_{op}$   | −55 ... +125        | °C                  |
| Failure rate (at 40 °C; ≤ $V_R$ , $R_S \geq 3 \Omega/V$ )<br>(1 fit = $1 \cdot 10^{-9}$ failures/h)<br>$C_R \cdot V_R \leq 330 \mu F \cdot V$<br>$C_R \cdot V_R > 330 \mu F \cdot V$ |            | ≤8<br>≤24           | fit                 |
| Service life                                                                                                                                                                         |            | >500000             | h                   |
| Leakage current ( $V_R$ , 5 min, 20 °C)                                                                                                                                              | $I_{leak}$ | 10                  | nA/μC               |
| Detail specification                                                                                                                                                                 |            | CECC 30801-802      |                     |
| Climatic category (to IEC 60068-1)<br>(−55 °C/+125 °C/56 days damp heat test)                                                                                                        |            | 55/125/56           |                     |

## Overview of types

| (VDC)<br>(up to 85 °C) | 4       | 6.3     | 10      | 16    | 20    | 25      | 35    | 50  |
|------------------------|---------|---------|---------|-------|-------|---------|-------|-----|
| C <sub>R</sub> (μF)    |         |         |         |       |       |         |       |     |
| 0.10                   |         |         |         |       |       |         | A     |     |
| 0.15                   |         |         |         |       |       |         | A     | A B |
| 0.22                   |         |         |         |       |       |         | A     | A B |
| 0.33                   |         |         |         |       |       |         | A     | B   |
| 0.47                   |         |         |         |       |       | A       | A B   | B C |
| 0.68                   |         |         |         |       | A     | A       | A B   | C   |
| 1.0                    |         |         |         | A     |       |         |       |     |
| 1.5                    |         |         | A       | A     | A     | A B     | A B C | C D |
| 2.2                    |         | A       | A       | A     | A B   | A B     | A B C | C D |
| 3.3                    | A       | A       | A       | A B   | A B   | A B C   | B C   | C D |
| 4.7                    | A       | A       | A B     | A B   | A B C | A B C   | B C D | D   |
| 6.8                    | A       | A B     | A B     | A B C | A B C | A B C D | C D   | D E |
| 10                     | A B     | A B     | A B C   | A B C | A B C | B C D   | C D   | D E |
| 15                     | A B     | A B C   | A B C   | A B C | B C D | B C D   | C D   | E   |
| 22                     | A B C   | A B C   | A B C   | B C D | B C D | C D     | D     | E   |
| 33                     | A B C   | A B C   | A B C D | B C D | C D   | C D E   | D E   |     |
| 47                     | A B C   | A B C D | B C D   | C D   | C D E | D E     | E     |     |
| 68                     | A B C D | A B C D | B C D   | C D   | D E   | E       |       |     |
| 100                    | A B C D | B C D   | B C D   | C D E | D E   | E       |       |     |
| 150                    | B C D   | B C D   | C D E   | D E   | E     |         |       |     |
| 220                    | B C D   | C D E   | C D E   | D E   | E     |         |       |     |
| 330                    | C D E   | C D E   | D E     | E     | E     |         |       |     |
| 470                    | C D E   | D E     | D E     | E     |       |         |       |     |
| 680                    | D E     | D E     | E       |       |       |         |       |     |
| 1000                   | E       | E       |         |       |       |         |       |     |
| 1500                   | E       | E       |         |       |       |         |       |     |

Upon request

## Ordering code structure

|                                                                                                                                                                           |             |          |            |          |           |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------|------------|----------|-----------|----------|
| <b>B45</b>                                                                                                                                                                | <b>196E</b> | <b>0</b> | <b>685</b> | <b>+</b> | <b>10</b> | <b>*</b> |
| <b>Tantalum capacitor</b>                                                                                                                                                 |             |          |            |          |           |          |
| <b>Series</b><br>196E = Standard, tinned terminals<br>198E = Standard, gold-plated terminals<br>196H = HighCap, tinned terminals<br>198H = HighCap, gold-plated terminals |             |          |            |          |           |          |
| <b>Rated voltage</b><br>0 = 4 V, 1 = 6.3 V, 2 = 10 V, 3 = 16 V, 4 = 20 V, 5 = 25 V,<br>6 = 35 V, 7 = 50 V                                                                 |             |          |            |          |           |          |
| <b>Rated capacitance + exponent</b><br>C [pF] · 10 <sup>x</sup><br>E.g.: 686 = 68 pF · 10 <sup>6</sup> = 68 µF, 157 = 15 pF · 10 <sup>7</sup> = 150 µF                    |             |          |            |          |           |          |
| <b>Capacitance tolerance</b><br>M = ±20%, K = ±10%                                                                                                                        |             |          |            |          |           |          |
| <b>Case size</b><br>10 = A<br>20 = B<br>30 = C<br>40 = D<br>50 = E                                                                                                        |             |          |            |          |           |          |
| <b>Reel diameter</b><br>9 = 180 mm, 6 = 330 mm                                                                                                                            |             |          |            |          |           |          |

## Technical data and ordering codes

| $C_R$<br>(20 °C, 120 Hz)<br><br>$\mu F$                     | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br>$\mu A$ | $Z_{max}$<br>(20 °C,<br>100 kHz)<br>$\Omega$ | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|--------------------------------------------------------|----------------------------------------------|-------------------|
| $V_R$ (up to 85 °C) = 4 VDC, $V_R$ (up to 125 °C) = 2.5 VDC |           |                                        |                                                        |                                              |                   |
| 3.3                                                         | A         | 6                                      | 0.5                                                    | 9.0                                          | B45196E0335+10*   |
| 4.7                                                         | A         | 6                                      | 0.5                                                    | 7.0                                          | B45196E0475+10*   |
| 6.8                                                         | A         | 6                                      | 0.5                                                    | 6.0                                          | B45196H0685+10*   |
| 10                                                          | A         | 6                                      | 0.5                                                    | 4.5                                          | B45196H0106+10*   |
| 10                                                          | B         | 6                                      | 0.5                                                    | 4.5                                          | B45196E0106+20*   |
| 15                                                          | A         | 6                                      | 0.6                                                    | 4.0                                          | B45196H0156+10*   |
| 15                                                          | B         | 6                                      | 0.6                                                    | 3.5                                          | B45196E0156+20*   |
| 22                                                          | A         | 8                                      | 0.9                                                    | 3.5                                          | B45196H0226+10*   |
| 22                                                          | B         | 6                                      | 0.9                                                    | 3.0                                          | B45196H0226+20*   |
| 22                                                          | C         | 6                                      | 0.9                                                    | 2.4                                          | B45196E0226+30*   |
| 33                                                          | A         | 8                                      | 1.3                                                    | 3.0                                          | B45196H0336+10*   |
| 33                                                          | B         | 6                                      | 1.3                                                    | 2.5                                          | B45196H0336+20*   |
| 33                                                          | C         | 6                                      | 1.3                                                    | 2.0                                          | B45196E0336+30*   |
| 47                                                          | A         | 10                                     | 1.9                                                    | 2.8                                          | B45196H0476+10*   |
| 47                                                          | B         | 6                                      | 1.9                                                    | 2.3                                          | B45196H0476+20*   |
| 47                                                          | C         | 6                                      | 1.9                                                    | 1.6                                          | B45196H0476+30*   |
| 68                                                          | A         | 30                                     | 2.7                                                    | 4.0                                          | B45196H0686M10* ● |
| 68                                                          | B         | 6                                      | 2.7                                                    | 1.8                                          | B45196H0686+20*   |
| 68                                                          | C         | 6                                      | 2.7                                                    | 1.5                                          | B45196H0686+30*   |
| 68                                                          | D         | 6                                      | 2.7                                                    | 1.1                                          | B45196E0686+40*   |
| 100                                                         | A         | 30                                     | 4.0                                                    | 4.0                                          | B45196H0107M10* ● |
| 100                                                         | B         | 8                                      | 4.0                                                    | 1.6                                          | B45196H0107+20*   |
| 100                                                         | C         | 8                                      | 4.0                                                    | 1.4                                          | B45196H0107+30*   |
| 100                                                         | D         | 8                                      | 4.0                                                    | 0.8                                          | B45196E0107+40*   |
| 150                                                         | B         | 10                                     | 6.0                                                    | 1.5                                          | B45196H0157+20* ● |
| 150                                                         | C         | 8                                      | 6.0                                                    | 1.3                                          | B45196H0157+30*   |
| 150                                                         | D         | 8                                      | 6.0                                                    | 0.8                                          | B45196H0157+40*   |
| 220                                                         | B         | 20                                     | 8.8                                                    | 1.5                                          | B45196H0227M20* ● |
| 220                                                         | C         | 15                                     | 8.8                                                    | 1.2                                          | B45196H0227+30*   |
| 220                                                         | D         | 8                                      | 8.8                                                    | 0.8                                          | B45196H0227+40*   |
| 330                                                         | C         | 15                                     | 13.2                                                   | 1.2                                          | B45196H0337+30* ● |
| 330                                                         | D         | 10                                     | 13.0                                                   | 0.9                                          | B45196H0337+40*   |

● Preliminary Data

\* = Code number for reel diameter  
6 = 330-mm reel  
9 = 180-mm reel

+ = Capacitance tolerance  
M =  $\pm 20\%$   
K =  $\pm 10\%$

| $C_R$<br>(20 °C, 120 Hz)<br><br>μF                          | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br><br>μA | $Z_{max}$<br>(20 °C,<br>100 kHz)<br><br>Ω | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|-------------------------------------------------------|-------------------------------------------|-------------------|
| 330                                                         | E         | 8                                      | 13.0                                                  | 0.8                                       | B45196H0337+50*   |
| 470                                                         | C         | 20                                     | 14.2                                                  | 1.2                                       | B45196H0477+30* ● |
| 470                                                         | D         | 10                                     | 19.0                                                  | 0.9                                       | B45196H0477+40*   |
| 470                                                         | E         | 8                                      | 19.0                                                  | 0.6                                       | B45196H0477+50*   |
| 680                                                         | D         | 12                                     | 27.2                                                  | 0.9                                       | B45196H0687+40*   |
| 680                                                         | E         | 12                                     | 27.0                                                  | 0.6                                       | B45196H0687+50*   |
| 1000                                                        | E         | 15                                     | 40.0                                                  | 0.6                                       | B45196H0108+50* ● |
| 1500                                                        | E         | 25                                     | 60.0                                                  | 0.6                                       | B45196H0158+50* ● |
| $V_R$ (up to 85 °C) = 6.3 VDC, $V_R$ (up to 125 °C) = 4 VDC |           |                                        |                                                       |                                           |                   |
| 2.2                                                         | A         | 6                                      | 0.5                                                   | 10.0                                      | B45196E1225+10*   |
| 3.3                                                         | A         | 6                                      | 0.5                                                   | 7.0                                       | B45196E1335+10*   |
| 4.7                                                         | A         | 6                                      | 0.5                                                   | 5.5                                       | B45196H1475+10*   |
| 6.8                                                         | A         | 6                                      | 0.5                                                   | 4.5                                       | B45196H1685+10*   |
| 6.8                                                         | B         | 6                                      | 0.5                                                   | 4.5                                       | B45196E1685+20*   |
| 10                                                          | A         | 6                                      | 0.6                                                   | 4.0                                       | B45196H1106+10*   |
| 10                                                          | B         | 6                                      | 0.6                                                   | 3.5                                       | B45196E1106+20*   |
| 15                                                          | A         | 6                                      | 0.9                                                   | 3.8                                       | B45196H1156+10*   |
| 15                                                          | B         | 6                                      | 0.9                                                   | 3.0                                       | B45196H1156+20*   |
| 15                                                          | C         | 6                                      | 1.0                                                   | 2.4                                       | B45196E1156+30*   |
| 22                                                          | A         | 8                                      | 1.4                                                   | 3.0                                       | B45196H1226+10*   |
| 22                                                          | B         | 6                                      | 1.4                                                   | 2.5                                       | B45196H1226+20*   |
| 22                                                          | C         | 6                                      | 1.4                                                   | 2.0                                       | B45196E1226+30*   |
| 33                                                          | A         | 10                                     | 2.1                                                   | 2.8                                       | B45196H1336+10*   |
| 33                                                          | B         | 6                                      | 2.1                                                   | 2.2                                       | B45196H1336+20*   |
| 33                                                          | C         | 6                                      | 2.1                                                   | 1.6                                       | B45196H1336+30*   |
| 47                                                          | A         | 15                                     | 3.0                                                   | 3.5                                       | B45196H1476M10* ● |
| 47                                                          | B         | 6                                      | 3.0                                                   | 2.0                                       | B45196H1476+20*   |
| 47                                                          | C         | 6                                      | 3.0                                                   | 1.5                                       | B45196H1476+30*   |
| 47                                                          | D         | 6                                      | 3.0                                                   | 1.1                                       | B45196E1476+40*   |
| 68                                                          | A         | 15                                     | 4.3                                                   | 3.5                                       | B45196H1686M10* ● |
| 68                                                          | B         | 8                                      | 4.3                                                   | 1.8                                       | B45196H1686+20*   |
| 68                                                          | C         | 6                                      | 4.3                                                   | 1.4                                       | B45196H1686+30*   |
| 68                                                          | D         | 6                                      | 4.3                                                   | 0.8                                       | B45196E1686+40*   |
| 100                                                         | B         | 12                                     | 6.3                                                   | 1.6                                       | B45196H1107+20*   |

● Preliminary Data

\* = Code number for reel diameter

6 = 330-mm reel

9 = 180-mm reel

+ = Capacitance tolerance

M = ±20%

K = ±10%

| $C_R$<br>(20 °C, 120 Hz)<br><br>μF                           | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br>μA | $Z_{max}$<br>(20 °C,<br>100 kHz)<br>Ω | Ordering code     |
|--------------------------------------------------------------|-----------|----------------------------------------|---------------------------------------------------|---------------------------------------|-------------------|
| 100                                                          | C         | 8                                      | 6.3                                               | 1.2                                   | B45196H1107+30*   |
| 100                                                          | D         | 8                                      | 6.3                                               | 0.8                                   | B45196H1107+40*   |
| 150                                                          | B         | 15                                     | 9.5                                               | 1.5                                   | B45196H1157M20* ● |
| 150                                                          | C         | 8                                      | 9.5                                               | 1.3                                   | B45196H1157+30*   |
| 150                                                          | D         | 8                                      | 9.5                                               | 0.8                                   | B45196H1157+40*   |
| 220                                                          | C         | 10                                     | 14.0                                              | 1.2                                   | B45196H1227+30*   |
| 220                                                          | D         | 8                                      | 14.0                                              | 0.8                                   | B45196H1227+40*   |
| 220                                                          | E         | 12                                     | 14.0                                              | 0.8                                   | B45196H1227+50*   |
| 330                                                          | C         | 15                                     | 20.8                                              | 0.5                                   | B45196H1337+30* ● |
| 330                                                          | D         | 8                                      | 21.0                                              | 0.8                                   | B45196H1337+40*   |
| 330                                                          | E         | 8                                      | 21.0                                              | 0.6                                   | B45196H1337+50*   |
| 470                                                          | D         | 15                                     | 30.0                                              | 0.9                                   | B45196H1477+40*   |
| 470                                                          | E         | 8                                      | 30.0                                              | 0.6                                   | B45196H1477+50*   |
| 680                                                          | D         | 20                                     | 42.8                                              | 0.5                                   | B45196H1687+40* ● |
| 680                                                          | E         | 15                                     | 43.0                                              | 0.6                                   | B45196H1687+50*   |
| 1000                                                         | E         | 20                                     | 63.0                                              | 0.6                                   | B45196H1108+50* ● |
| 1500                                                         | E         | 25                                     | 60.0                                              | 0.6                                   | B45196H1158+50* ● |
| $V_R$ (up to 85 °C) = 10 VDC, $V_R$ (up to 125 °C) = 6.3 VDC |           |                                        |                                                   |                                       |                   |
| 1.5                                                          | A         | 6                                      | 0.5                                               | 10.0                                  | B45196E2155+10*   |
| 2.2                                                          | A         | 6                                      | 0.5                                               | 7.0                                   | B45196E2225+10*   |
| 3.3                                                          | A         | 6                                      | 0.5                                               | 5.5                                   | B45196H2335+10*   |
| 4.7                                                          | A         | 6                                      | 0.5                                               | 4.5                                   | B45196H2475+10*   |
| 4.7                                                          | B         | 6                                      | 0.5                                               | 4.5                                   | B45196E2475+20*   |
| 6.8                                                          | A         | 6                                      | 0.7                                               | 4.0                                   | B45196H2685+10*   |
| 6.8                                                          | B         | 6                                      | 0.7                                               | 3.5                                   | B45196E2685+20*   |
| 10                                                           | A         | 6                                      | 1.0                                               | 3.8                                   | B45196H2106+10*   |
| 10                                                           | B         | 6                                      | 1.0                                               | 3.0                                   | B45196H2106+20*   |
| 10                                                           | C         | 6                                      | 1.0                                               | 2.4                                   | B45196E2106+30*   |
| 15                                                           | A         | 6                                      | 1.5                                               | 3.2                                   | B45196H2156+10*   |
| 15                                                           | B         | 6                                      | 1.5                                               | 2.5                                   | B45196H2156+20*   |
| 15                                                           | C         | 6                                      | 1.5                                               | 2.0                                   | B45196E2156+30*   |
| 22                                                           | A         | 8                                      | 2.2                                               | 3.2                                   | B45196H2226+10*   |
| 22                                                           | B         | 6                                      | 2.2                                               | 2.3                                   | B45196H2226+20*   |
| 22                                                           | C         | 6                                      | 2.2                                               | 1.6                                   | B45196H2226+30*   |

● Preliminary Data

\* = Code number for reel diameter  
6 = 330-mm reel  
9 = 180-mm reel

+ = Capacitance tolerance  
M = ±20%  
K = ±10%

| $C_R$<br>(20 °C, 120 Hz)<br><br>μF                          | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br><br>μA | $Z_{max}$<br>(20 °C,<br>100 kHz)<br><br>Ω | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|-------------------------------------------------------|-------------------------------------------|-------------------|
| 33                                                          | A         | 10                                     | 3.3                                                   | 3.0                                       | B45196H2336M10* ● |
| 33                                                          | B         | 6                                      | 3.3                                                   | 2.0                                       | B45196H2336+20*   |
| 33                                                          | C         | 6                                      | 3.0                                                   | 1.5                                       | B45196H2336+30*   |
| 33                                                          | D         | 6                                      | 3.3                                                   | 1.1                                       | B45196E2336+40*   |
| 47                                                          | B         | 8                                      | 4.7                                                   | 1.6                                       | B45196H2476+20*   |
| 47                                                          | C         | 6                                      | 4.7                                                   | 1.4                                       | B45196H2476+30*   |
| 47                                                          | D         | 6                                      | 4.7                                                   | 0.8                                       | B45196E2476+40*   |
| 68                                                          | B         | 8                                      | 6.8                                                   | 1.2                                       | B45196H2686+20* ● |
| 68                                                          | C         | 6                                      | 6.8                                                   | 1.2                                       | B45196H2686+30*   |
| 68                                                          | D         | 6                                      | 6.8                                                   | 0.8                                       | B45196H2686+40*   |
| 100                                                         | B         | 12                                     | 10.0                                                  | 1.2                                       | B45196H2107M20* ● |
| 100                                                         | C         | 8                                      | 10.0                                                  | 1.2                                       | B45196H2107+30*   |
| 100                                                         | D         | 8                                      | 10.0                                                  | 0.8                                       | B45196H2107+40*   |
| 150                                                         | C         | 10                                     | 15.0                                                  | 1.0                                       | B45196H2157+30* ● |
| 150                                                         | D         | 8                                      | 15.0                                                  | 0.8                                       | B45196H2157+40*   |
| 150                                                         | E         | 8                                      | 15.0                                                  | 0.8                                       | B45196H2157+50*   |
| 220                                                         | C         | 10                                     | 22.0                                                  | 0.9                                       | B45196H2227+30* ● |
| 220                                                         | D         | 10                                     | 22.0                                                  | 0.8                                       | B45196H2227+40*   |
| 220                                                         | E         | 8                                      | 22.0                                                  | 0.6                                       | B45196H2227+50*   |
| 330                                                         | D         | 12                                     | 33.0                                                  | 0.9                                       | B45196H2337+40*   |
| 330                                                         | E         | 10                                     | 33.0                                                  | 0.6                                       | B45196H2337+50*   |
| 470                                                         | D         | 15                                     | 47.0                                                  | 0.5                                       | B45196H2477+40* ● |
| 470                                                         | E         | 12                                     | 47.0                                                  | 0.6                                       | B45196H2477+50*   |
| 680                                                         | E         | 15                                     | 68.0                                                  | 0.6                                       | B45196H2687+50* ● |
| $V_R$ (up to 85 °C) = 16 VDC, $V_R$ (up to 125 °C) = 10 VDC |           |                                        |                                                       |                                           |                   |
| 1.0                                                         | A         | 4                                      | 0.5                                                   | 10.0                                      | B45196E3105+10*   |
| 1.5                                                         | A         | 6                                      | 0.5                                                   | 8.0                                       | B45196E3155+10*   |
| 2.2                                                         | A         | 6                                      | 0.5                                                   | 6.5                                       | B45196H3225+10*   |
| 3.3                                                         | A         | 6                                      | 0.5                                                   | 5.0                                       | B45196H3335+10*   |
| 3.3                                                         | B         | 6                                      | 0.6                                                   | 5.0                                       | B45196E3335+20*   |
| 4.7                                                         | A         | 6                                      | 0.8                                                   | 4.0                                       | B45196H3475+10*   |
| 4.7                                                         | B         | 6                                      | 0.8                                                   | 3.5                                       | B45196E3475+20*   |
| 6.8                                                         | A         | 6                                      | 1.1                                                   | 3.8                                       | B45196H3685+10*   |
| 6.8                                                         | B         | 6                                      | 1.1                                                   | 3.0                                       | B45196H3685+20*   |

● Preliminary Data

\* = Code number for reel diameter  
 6 = 330-mm reel  
 9 = 180-mm reel

+ = Capacitance tolerance  
 M = ±20%  
 K = ±10%

| $C_R$<br>(20 °C, 120 Hz)<br><br>$\mu F$                     | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br>$\mu A$ | $Z_{max}$<br>(20 °C,<br>100 kHz)<br>$\Omega$ | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|--------------------------------------------------------|----------------------------------------------|-------------------|
| 6.8                                                         | C         | 6                                      | 1.1                                                    | 2.4                                          | B45196E3685+30*   |
| 10                                                          | A         | 6                                      | 1.6                                                    | 3.0                                          | B45196H3106+10*   |
| 10                                                          | B         | 6                                      | 1.6                                                    | 2.5                                          | B45196H3106+20*   |
| 10                                                          | C         | 6                                      | 1.6                                                    | 2.0                                          | B45196E3106+30*   |
| 15                                                          | A         | 8                                      | 2.4                                                    | 3.5                                          | B45196H3156+10* ● |
| 15                                                          | B         | 6                                      | 2.4                                                    | 2.3                                          | B45196H3156+20*   |
| 15                                                          | C         | 6                                      | 2.4                                                    | 1.6                                          | B45196H3156+30*   |
| 22                                                          | B         | 6                                      | 3.5                                                    | 2.6                                          | B45196H3226+20*   |
| 22                                                          | C         | 6                                      | 3.5                                                    | 1.5                                          | B45196H3226+30*   |
| 22                                                          | D         | 6                                      | 3.6                                                    | 1.1                                          | B45196E3226+40*   |
| 33                                                          | B         | 8                                      | 5.3                                                    | 2.1                                          | B45196H3336+20* ● |
| 33                                                          | C         | 6                                      | 5.3                                                    | 1.4                                          | B45196H3336+30*   |
| 33                                                          | D         | 6                                      | 5.3                                                    | 1.0                                          | B45196E3336+40*   |
| 47                                                          | C         | 6                                      | 7.5                                                    | 1.4                                          | B45196H3476+30*   |
| 47                                                          | D         | 6                                      | 7.5                                                    | 0.8                                          | B45196H3476+40*   |
| 68                                                          | C         | 6                                      | 11.0                                                   | 1.2                                          | B45196H3686+30*   |
| 68                                                          | D         | 6                                      | 11.0                                                   | 0.8                                          | B45196H3686+40*   |
| 100                                                         | C         | 10                                     | 16.0                                                   | 1.0                                          | B45196H3107+30* ● |
| 100                                                         | D         | 8                                      | 16.0                                                   | 0.8                                          | B45196H3107+40*   |
| 100                                                         | E         | 8                                      | 16.0                                                   | 0.8                                          | B45196H3107+50*   |
| 150                                                         | D         | 10                                     | 24.0                                                   | 0.9                                          | B45196H3157+40*   |
| 150                                                         | E         | 8                                      | 24.0                                                   | 0.6                                          | B45196H3157+50*   |
| 220                                                         | D         | 15                                     | 35.2                                                   | 0.9                                          | B45196H3227+40* ● |
| 220                                                         | E         | 10                                     | 35.0                                                   | 0.9                                          | B45196H3227+50*   |
| 330                                                         | E         | 12                                     | 52.8                                                   | 0.4                                          | B45196H3337+50* ● |
| $V_R$ (up to 85 °C) = 20 VDC, $V_R$ (up to 125 °C) = 13 VDC |           |                                        |                                                        |                                              |                   |
| 0.68                                                        | A         | 4                                      | 0.5                                                    | 12.0                                         | B45196E4684+10*   |
| 1                                                           | A         | 4                                      | 0.5                                                    | 9.0                                          | B45196E4105+10*   |
| 1.5                                                         | A         | 6                                      | 0.5                                                    | 8.0                                          | B45196H4155+10*   |
| 2.2                                                         | A         | 6                                      | 0.5                                                    | 6.0                                          | B45196H4225+10*   |
| 2.2                                                         | B         | 6                                      | 0.5                                                    | 6.0                                          | B45196E4225+20*   |
| 3.3                                                         | A         | 6                                      | 0.7                                                    | 4.0                                          | B45196H4335+10*   |
| 3.3                                                         | B         | 6                                      | 0.7                                                    | 4.5                                          | B45196E4335+20*   |
| 4.7                                                         | A         | 6                                      | 0.9                                                    | 3.5                                          | B45196H4475+10*   |

● Preliminary Data

\* = Code number for reel diameter  
6 = 330-mm reel  
9 = 180-mm reel

+ = Capacitance tolerance  
M =  $\pm 20\%$   
K =  $\pm 10\%$

| $C_R$<br>(20 °C, 120 Hz)<br><br>μF                          | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br><br>μA | $Z_{max}$<br>(20 °C,<br>100 kHz)<br><br>Ω | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|-------------------------------------------------------|-------------------------------------------|-------------------|
| 4.7                                                         | B         | 6                                      | 0.9                                                   | 3.0                                       | B45196H4475+20*   |
| 4.7                                                         | C         | 6                                      | 1.0                                                   | 2.4                                       | B45196E4475+30*   |
| 6.8                                                         | A         | 6                                      | 1.4                                                   | 3.0                                       | B45196H4685+10* ● |
| 6.8                                                         | B         | 6                                      | 1.4                                                   | 2.5                                       | B45196H4685+20*   |
| 6.8                                                         | C         | 6                                      | 1.4                                                   | 2.0                                       | B45196E4685+30*   |
| 10                                                          | A         | 8                                      | 2.0                                                   | 4.0                                       | B45196H4106+10* ● |
| 10                                                          | B         | 6                                      | 2.0                                                   | 2.3                                       | B45196H4106+20*   |
| 10                                                          | C         | 6                                      | 2.0                                                   | 1.6                                       | B45196H4106+30*   |
| 15                                                          | B         | 6                                      | 3.0                                                   | 2.5                                       | B45196H4156+20* ● |
| 15                                                          | C         | 6                                      | 3.0                                                   | 1.5                                       | B45196H4156+30*   |
| 15                                                          | D         | 6                                      | 3.0                                                   | 1.2                                       | B45196E4156+40*   |
| 22                                                          | B         | 6                                      | 4.4                                                   | 2.5                                       | B45196H4226+20* ● |
| 22                                                          | C         | 6                                      | 4.4                                                   | 1.4                                       | B45196H4226+30*   |
| 22                                                          | D         | 6                                      | 4.4                                                   | 1.0                                       | B45196E4226+40*   |
| 33                                                          | C         | 6                                      | 6.6                                                   | 1.5                                       | B45196H4336+30*   |
| 33                                                          | D         | 6                                      | 6.6                                                   | 0.8                                       | B45196H4336+40*   |
| 47                                                          | C         | 6                                      | 9.4                                                   | 0.9                                       | B45196H4476+30* ● |
| 47                                                          | D         | 6                                      | 9.4                                                   | 0.8                                       | B45196H4476+40*   |
| 47                                                          | E         | 6                                      | 9.4                                                   | 0.8                                       | B45196H4476+50*   |
| 68                                                          | D         | 6                                      | 14.0                                                  | 0.9                                       | B45196H4686+40*   |
| 68                                                          | E         | 6                                      | 14.0                                                  | 0.8                                       | B45196H4686+50*   |
| 100                                                         | D         | 8                                      | 20.0                                                  | 0.9                                       | B45196H4107+40* ● |
| 100                                                         | E         | 8                                      | 20.0                                                  | 0.8                                       | B45196H4107+50*   |
| 150                                                         | E         | 10                                     | 30.0                                                  | 0.4                                       | B45196H4157+50* ● |
| $V_R$ (up to 85 °C) = 25 VDC, $V_R$ (up to 125 °C) = 16 VDC |           |                                        |                                                       |                                           |                   |
| 0.47                                                        | A         | 4                                      | 0.5                                                   | 13.0                                      | B45196E5474+10*   |
| 0.68                                                        | A         | 4                                      | 0.5                                                   | 10.0                                      | B45196E5684+10*   |
| 1                                                           | A         | 4                                      | 0.5                                                   | 8.0                                       | B45196H5105+10*   |
| 1.5                                                         | A         | 6                                      | 0.5                                                   | 7.0                                       | B45196H5155+10*   |
| 1.5                                                         | B         | 6                                      | 0.5                                                   | 7.0                                       | B45196E5155+20*   |
| 2.2                                                         | A         | 6                                      | 0.6                                                   | 7.0                                       | B45196H5225+10*   |
| 2.2                                                         | B         | 6                                      | 0.6                                                   | 5.0                                       | B45196E5225+20*   |
| 3.3                                                         | A         | 6                                      | 0.8                                                   | 3.7                                       | B45196H5335+10* ● |
| 3.3                                                         | B         | 6                                      | 0.8                                                   | 4.0                                       | B45196H5335+20*   |

● Preliminary Data

\* = Code number for reel diameter  
 6 = 330-mm reel  
 9 = 180-mm reel

+ = Capacitance tolerance  
 M = ±20%  
 K = ±10%

| $C_R$<br>(20 °C, 120 Hz)<br><br>$\mu F$                     | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br>$\mu A$ | $Z_{max}$<br>(20 °C,<br>100 kHz)<br>$\Omega$ | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|--------------------------------------------------------|----------------------------------------------|-------------------|
| 3.3                                                         | C         | 6                                      | 0.9                                                    | 2.8                                          | B45196E5335+30*   |
| 4.7                                                         | A         | 8                                      | 1.2                                                    | 4.0                                          | B45196H5475+10* ● |
| 4.7                                                         | B         | 6                                      | 1.2                                                    | 3.2                                          | B45196H5475+20*   |
| 4.7                                                         | C         | 6                                      | 1.2                                                    | 2.3                                          | B45196E5475+30*   |
| 6.8                                                         | A         | 8                                      | 1.7                                                    | 4.0                                          | B45196H5685+10* ● |
| 6.8                                                         | B         | 6                                      | 1.7                                                    | 2.8                                          | B45196H5685+20*   |
| 6.8                                                         | C         | 6                                      | 1.7                                                    | 2.0                                          | B45196H5685+30*   |
| 6.8                                                         | D         | 6                                      | 1.7                                                    | 1.8                                          | B45196E5685+40*   |
| 10                                                          | B         | 6                                      | 2.5                                                    | 2.5                                          | B45196H5106+20* ● |
| 10                                                          | C         | 6                                      | 2.5                                                    | 1.6                                          | B45196H5106+30*   |
| 10                                                          | D         | 6                                      | 2.5                                                    | 1.2                                          | B45196E5106+40*   |
| 15                                                          | B         | 8                                      | 3.8                                                    | 2.5                                          | B45196H5156+20* ● |
| 15                                                          | C         | 6                                      | 3.8                                                    | 1.5                                          | B45196H5156+30*   |
| 15                                                          | D         | 6                                      | 3.8                                                    | 1.0                                          | B45196E5156+40*   |
| 22                                                          | C         | 6                                      | 5.5                                                    | 1.4                                          | B45196H5226+30*   |
| 22                                                          | D         | 6                                      | 5.5                                                    | 0.8                                          | B45196H5226+40*   |
| 33                                                          | C         | 6                                      | 8.3                                                    | 0.9                                          | B45196H5336+30* ● |
| 33                                                          | D         | 6                                      | 8.3                                                    | 0.8                                          | B45196H5336+40*   |
| 33                                                          | E         | 6                                      | 8.3                                                    | 0.8                                          | B45196H5336+50*   |
| 47                                                          | D         | 6                                      | 12.0                                                   | 0.8                                          | B45196H5476+40*   |
| 47                                                          | E         | 6                                      | 12.0                                                   | 0.8                                          | B45196H5476+50*   |
| 68                                                          | E         | 6                                      | 17.0                                                   | 0.9                                          | B45196H5686+50*   |
| 100                                                         | E         | 10                                     | 25.0                                                   | 0.4                                          | B45196H5107+50* ● |
| $V_R$ (up to 85 °C) = 35 VDC, $V_R$ (up to 125 °C) = 23 VDC |           |                                        |                                                        |                                              |                   |
| 0.10                                                        | A         | 4                                      | 0.5                                                    | 28.0                                         | B45196E6104+10*   |
| 0.15                                                        | A         | 4                                      | 0.5                                                    | 23.0                                         | B45196E6154+10*   |
| 0.22                                                        | A         | 4                                      | 0.5                                                    | 19.0                                         | B45196E6224+10*   |
| 0.33                                                        | A         | 4                                      | 0.5                                                    | 15.0                                         | B45196E6334+10*   |
| 0.47                                                        | A         | 4                                      | 0.5                                                    | 11.0                                         | B45196H6474+10*   |
| 0.47                                                        | B         | 4                                      | 0.5                                                    | 11.0                                         | B45196E6474+20*   |
| 0.68                                                        | A         | 4                                      | 0.5                                                    | 8.0                                          | B45196H6684+10*   |
| 0.68                                                        | B         | 4                                      | 0.5                                                    | 8.0                                          | B45196E6684+20*   |
| 1                                                           | A         | 4                                      | 0.5                                                    | 7.0                                          | B45196H6105+10*   |
| 1                                                           | B         | 4                                      | 0.5                                                    | 7.0                                          | B45196E6105+20*   |

● Preliminary Data

\* = Code number for reel diameter  
6 = 330-mm reel  
9 = 180-mm reel

+ = Capacitance tolerance  
M =  $\pm 20\%$   
K =  $\pm 10\%$

| $C_R$<br>(20 °C, 120 Hz)<br><br>μF                          | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br><br>μA | $Z_{max}$<br>(20 °C,<br>100 kHz)<br><br>Ω | Ordering code     |
|-------------------------------------------------------------|-----------|----------------------------------------|-------------------------------------------------------|-------------------------------------------|-------------------|
| 1.5                                                         | A         | 6                                      | 0.5                                                   | 7.5                                       | B45196H6155+10* ● |
| 1.5                                                         | B         | 6                                      | 0.5                                                   | 6.0                                       | B45196H6155+20*   |
| 1.5                                                         | C         | 6                                      | 0.6                                                   | 4.8                                       | B45196E6155+30*   |
| 2.2                                                         | A         | 6                                      | 0.8                                                   | 4.5                                       | B45196H6225+10* ● |
| 2.2                                                         | B         | 6                                      | 0.8                                                   | 4.0                                       | B45196H6225+20*   |
| 2.2                                                         | C         | 6                                      | 0.8                                                   | 3.2                                       | B45196E6225+30*   |
| 3.3                                                         | B         | 6                                      | 1.2                                                   | 3.5                                       | B45196H6335+20*   |
| 3.3                                                         | C         | 6                                      | 1.2                                                   | 2.4                                       | B45196E6335+30*   |
| 4.7                                                         | B         | 6                                      | 1.6                                                   | 3.1                                       | B45196H6475+20* ● |
| 4.7                                                         | C         | 6                                      | 1.6                                                   | 2.0                                       | B45196H6475+30*   |
| 4.7                                                         | D         | 6                                      | 1.7                                                   | 1.5                                       | B45196E6475+40*   |
| 6.8                                                         | C         | 6                                      | 2.4                                                   | 1.8                                       | B45196H6685+30*   |
| 6.8                                                         | D         | 6                                      | 2.4                                                   | 1.2                                       | B45196E6685+40*   |
| 10                                                          | C         | 6                                      | 3.5                                                   | 1.6                                       | B45196H6106+30*   |
| 10                                                          | D         | 6                                      | 3.5                                                   | 1.0                                       | B45196E6106+40*   |
| 15                                                          | C         | 6                                      | 5.3                                                   | 1.4                                       | B45196H6156+30* ● |
| 15                                                          | D         | 6                                      | 5.3                                                   | 0.8                                       | B45196H6156+40*   |
| 22                                                          | D         | 6                                      | 7.7                                                   | 0.8                                       | B45196H6226+40*   |
| 22                                                          | E         | 6                                      | 7.7                                                   | 0.8                                       | B45196H6226+50*   |
| 33                                                          | D         | 8                                      | 11.6                                                  | 0.9                                       | B45196H6336+40* ● |
| 33                                                          | E         | 6                                      | 12.0                                                  | 0.8                                       | B45196H6336+50*   |
| 47                                                          | E         | 6                                      | 16.0                                                  | 0.9                                       | B45196H6476+50*   |
| $V_R$ (up to 85 °C) = 50 VDC, $V_R$ (up to 125 °C) = 33 VDC |           |                                        |                                                       |                                           |                   |
| 0.1                                                         | A         | 4                                      | 0.5                                                   | 27.0                                      | B45196E7104+10*   |
| 0.15                                                        | A         | 4                                      | 0.5                                                   | 22.0                                      | B45196H7154+10*   |
| 0.15                                                        | B         | 4                                      | 0.5                                                   | 22.0                                      | B45196E7154+20*   |
| 0.22                                                        | A         | 4                                      | 0.5                                                   | 18.0                                      | B45196H7224+10*   |
| 0.22                                                        | B         | 4                                      | 0.5                                                   | 18.0                                      | B45196E7224+20*   |
| 0.33                                                        | B         | 4                                      | 0.5                                                   | 14.0                                      | B45196E7334+20*   |
| 0.47                                                        | B         | 4                                      | 0.5                                                   | 9.0                                       | B45196H7474+20*   |
| 0.47                                                        | C         | 4                                      | 0.5                                                   | 7.2                                       | B45196E7474+30*   |
| 0.68                                                        | C         | 4                                      | 0.5                                                   | 6.4                                       | B45196E7684+30*   |
| 1                                                           | C         | 4                                      | 0.5                                                   | 4.8                                       | B45196E7105+30*   |
| 1.5                                                         | C         | 6                                      | 0.8                                                   | 4.4                                       | B45196H7155+30*   |

● Preliminary Data

\* = Code number for reel diameter

6 = 330-mm reel

9 = 180-mm reel

+ = Capacitance tolerance

M = ±20%

K = ±10%

| $C_R$<br>(20 °C, 120 Hz)<br><br>$\mu F$ | Case size | $DF_{max}$<br>(20 °C, 120 Hz)<br><br>% | $I_{leak,max}$<br>(20 °C, $V_R$ ,<br>5 min)<br>$\mu A$ | $Z_{max}$<br>(20 °C,<br>100 kHz)<br>$\Omega$ | Ordering code     |
|-----------------------------------------|-----------|----------------------------------------|--------------------------------------------------------|----------------------------------------------|-------------------|
| 1.5                                     | D         | 6                                      | 0.8                                                    | 4.0                                          | B45196E7155+40*   |
| 2.2                                     | C         | 6                                      | 1.1                                                    | 3.2                                          | B45196H7225+30*   |
| 2.2                                     | D         | 6                                      | 1.1                                                    | 2.8                                          | B45196E7225+40*   |
| 3.3                                     | C         | 6                                      | 1.7                                                    | 2.5                                          | B45196H7335+30*   |
| 3.3                                     | D         | 6                                      | 1.7                                                    | 1.6                                          | B45196E7335+40*   |
| 4.7                                     | D         | 6                                      | 2.4                                                    | 1.2                                          | B45196E7475+40*   |
| 6.8                                     | D         | 6                                      | 3.4                                                    | 0.8                                          | B45196H7685+40*   |
| 6.8                                     | E         | 6                                      | 3.4                                                    | 0.8                                          | B45196H7685+50*   |
| 10                                      | D         | 8                                      | 5.0                                                    | 0.8                                          | B45196H7106+40* ● |
| 10                                      | E         | 6                                      | 5.0                                                    | 0.8                                          | B45196H7106+50*   |
| 15                                      | E         | 6                                      | 7.5                                                    | 0.9                                          | B45196H7156+50*   |

● Preliminary Data

\* = Code number for reel diameter

6 = 330-mm reel

9 = 180-mm reel

+ = Capacitance tolerance

M =  $\pm 20\%$

K =  $\pm 10\%$

## Cautions and warnings

When using tantalum capacitors with a manganese dioxide coating, the following cautions and warnings should be taken into account:

### Polarity

Because tantalum capacitors are *polar capacitors*, it is important to observe their polarity markings (positive pole on the anode, negative pole on the cathode). Any incorrect polarity resulting from the sum of the AC and DC voltage components must be smaller than or equal to the permitted *polarity reversal voltage*. To avoid reducing their reliability, this voltage may only occur for a short time, at most five times for a duration of one minute per hour.

### Voltage

The *maximum continuous voltage* depends on the ambient temperature. Within the temperature range of  $-55$  to  $+85$  °C, the rated voltage is equal to the maximum continuous voltage. Between  $+85$  and  $+125$  °C the maximum continuous voltage must be reduced linearly from the full rated voltage to 2/3 of it (derating). At  $150$  °C (only B4519\*P series) the voltage must be reduced to 1/2 and at  $175$  °C (only B4519\*T series) to 1/3 of the rated voltage. Operation below the maximum continuous voltage has a positive effect on the capacitor's failure rate. The maximum continuous voltage must not be exceeded.

All unfavourable operating conditions (such as possible line overvoltages, unfavourable tolerances of the transformation ratio of the line transformer in the equipment, repeated overvoltages when the equipment is switched on, high ambient temperatures) must be taken into account when determining the *operating voltage*.

The *surge voltage* is the maximum voltage (peak value) that may be applied to the capacitor for short periods, at most five times for a total duration of up to 1 minute per hour. The surge voltage must not be applied for periodic charging and discharging in the course of normal operation and cannot be part of the operating voltage. The permissible surge voltage for all capacitors in this data book is  $1.3 \times$  the rated voltage. The occurrence of voltage impulses (transient voltages) that exceed the surge voltage may lead to irreparable damage.

### Capacitance

The actual *capacitance* of a capacitor can deviate from the rated capacitance by as much as the full magnitude of the tolerance at delivery. The capacitance varies with the temperature (at  $+125$  °C  $+12\%$  up to  $+20\%$ ) and decreases with increasing frequency.

**Low-resistance applications and voltage networks**

For *low-resistance applications*, KEMET recommends a maximum operating voltage of half the permissible maximum continuous voltage, so that the capacitors have sufficient tolerance to withstand voltage peaks. Depending on the conditions of use, the early failure rate is higher here by a factor of 2 to 20 than in the range with a constant failure rate as specified in the data book.

When operated directly in a *voltage network*, the capacitor should be protected against overvoltage, e.g. by a suppressor diode, and against polarity reversal by a diode. If a capacitor is operated in an unprotected low-impedance circuit and fails because the permissible conditions for the forward DC voltage, reverse DC voltage, surge current, power dissipation or temperature are exceeded, the continued current flow through the overstressed capacitor may produce overheating. The overheated capacitor may damage the surrounding components and the circuit board.

**Storage conditions**

Capacitors with solid electrolyte may be stored at temperatures down to  $-80\text{ }^{\circ}\text{C}$ . The upper *storage temperature* must not exceed  $+85\text{ }^{\circ}\text{C}$  (for blister tape the temperature limit is  $+40\text{ }^{\circ}\text{C}$ ). The storage conditions should not exceed  $+40\text{ }^{\circ}\text{C}$  and 70% R. H. A drypack is useful to prevent the effects of humidity.

## Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, KEMET is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a KEMET product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of passive electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of a passive electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of a passive electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as “hazardous”)**. Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.  
We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the “General Terms of Delivery for Products and Services in the Electrical Industry” published by the German Electrical and Electronics Industry Association (ZVEI).**