Film Capacitors - AC Capacitors

General Purpose MKP AC Capacitors

Series/Type: CBB65A-1
Ordering code: B33331V series
Date: 2019-04-10
Version: 2

© TDK Electronics AG 2019. Reproduction, publication and dissemination of this publication, enclosures hereto and the information contained therein without TDK Electronics’ prior express consent is prohibited.
Film Capacitors - AC Capacitors

General Purpose MKP AC Capacitors

B33331V series

CBB65A-1

**Construction**
- Metallized polypropylene film
- Filling material: soft polyurethane resin
- Aluminum can and top

**Features**
- Overpressure disconnection safety device
- UL approved for diameter > 40 mm
- Humidity protected: 85 °C, 85 % rel. humidity (RH) at 460 V for 1000 h
- Low dissipation factor
- Self-healing technology
- Indoor mounting
- CE compatible

**Typical applications**
- For general AC filtering application

**Terminals**
- 2+2 fast-on terminal 6.3 x 0.8mm #250 style, others on request

**Mounting parts (optional)**
- Threaded stud at bottom of can
  (M8, max torque = 5 Nm for 50 mm diameter)

---

**Technical data and specifications**

<table>
<thead>
<tr>
<th>Reference standards</th>
<th>IEC 61071, UL 810</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $V_r$</td>
<td>650 V</td>
</tr>
<tr>
<td>Rated AC RMS voltage $V_{RMS}$</td>
<td>460 V</td>
</tr>
<tr>
<td>Rated capacitance $C_R$</td>
<td>See table</td>
</tr>
<tr>
<td>Tolerance</td>
<td>± 5%</td>
</tr>
<tr>
<td>Dielectric Dissipation factor $\tan \delta$ at +20 °C</td>
<td>≤ 2 • 10⁻⁴ at 1 kHz</td>
</tr>
<tr>
<td>Life test</td>
<td>IEC 61071</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>100 000 h for $V_{RMS}$</td>
</tr>
</tbody>
</table>

**Maximum ratings**

<table>
<thead>
<tr>
<th>Maximum permissible voltage $V_{max}$</th>
<th>1.10 • $V_r$: 8 h/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.15 • $V_r$: 30 min/day</td>
</tr>
<tr>
<td></td>
<td>1.20 • $V_r$: 5 min/day</td>
</tr>
<tr>
<td></td>
<td>1.30 • $V_r$: 1 min/day</td>
</tr>
</tbody>
</table>

| Maximum permissible current $I_{max}$ | See table |
### Test data

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC test voltage terminal to terminal $V_{TT}$</td>
<td>975 V, 2 s</td>
</tr>
<tr>
<td>AC test voltage terminal to case $V_{TC}$</td>
<td>2200 V, 2 s</td>
</tr>
<tr>
<td>Dissipation factor $\tan \delta$ at +20 °C</td>
<td>$\leq 10 \times 10^{-4}$ at 120 Hz</td>
</tr>
</tbody>
</table>

### Climatic data

<table>
<thead>
<tr>
<th>Climatic Data Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climatic category</td>
<td>40/085/21 to IEC 60068-1</td>
</tr>
<tr>
<td>Lower category $\theta_{\min}$</td>
<td>-40 °C</td>
</tr>
<tr>
<td>Upper category $\theta_{\max}$</td>
<td>+85 °C</td>
</tr>
<tr>
<td>Maximum hot spot temperature $\theta_{HS}$</td>
<td>+85 °C</td>
</tr>
<tr>
<td>Damp heat test $t_{test}$</td>
<td>21 days</td>
</tr>
</tbody>
</table>

### Enforced humidity protection

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>+85 °C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>85 %</td>
</tr>
<tr>
<td>Duration</td>
<td>1000 h</td>
</tr>
<tr>
<td>Applied voltage $U_{RMS}$</td>
<td></td>
</tr>
<tr>
<td>Criteria</td>
<td></td>
</tr>
<tr>
<td>Capacitance deviation $\Delta C$</td>
<td>$\pm 10%$</td>
</tr>
<tr>
<td>Dissipation factor variation $\Delta \tan \delta$</td>
<td>$&lt; +0.005$</td>
</tr>
</tbody>
</table>

### Mechanical and thermal properties of terminal insulator material

| Terminal material: UL 94 V0 compatible | Self-extinguishing within 2 seconds of withdrawing glow wire without igniting wrapping tissue of GWT |

### Compatibility to RoHS

| Compliance to directive 2011/65/EU | RoHS compatible |

### Approvals

<table>
<thead>
<tr>
<th>US UL File E 238746</th>
<th>Approved component 10000 AFC. See table for approved ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>Compliance to LV directive 2014/35/EU</td>
</tr>
</tbody>
</table>
Dimensional drawings and marking

**Note:** Check the table before marking UL.

UL to be marked only for rating between 25 µF to 50 µF.

Don’t mark UL for rating between 2 µF to 20 µF. In the blank space, the marking can be shifted left.

**Drawing 1**

**Drawing 2**
Marking specification

With UL

$$C_R \ \mu F \quad V_{RMS} \ 460V~ \quad U_N \ 650V~$$

No PCB's CBB65A-1 IEC 61071 50/60Hz
B33331V 40/85/21 Protected E238746
Overpressure disconnector SH 10 K
Discharge before handling Made by EPCOS P.O. No.

Without UL

$$C_R \ \mu F \quad V_{RMS} \ 460V~ \quad U_N \ 650V~$$

No PCB's CBB65A-1 IEC 61071
B33331V 40/85/21 Protected
Overpressure disconnector 50/60Hz
Discharge before handling SH
Made by EPCOS P.O. No.

Expected lifetime

**Lifetime vs voltage (@HS temperature)**

![Graph showing lifetime vs voltage](image-url)

- **Lifetime (hours)**
- **Voltage (V/V_{RMS})**

---

Please read Cautions and warnings and Important notes at the end of this document.
Expected fit rate

![Graph showing failure rate vs voltage](image)

Ordering codes and packing unit

<table>
<thead>
<tr>
<th>$V_R$</th>
<th>$V_{RMS}$</th>
<th>$C_R$ (µF)</th>
<th>$I_{max}$ (A)</th>
<th>$I$ (A)</th>
<th>$ESR$ (mΩ)</th>
<th>$D_1$ (D x H)</th>
<th>$L$ (mm)</th>
<th>Drawing</th>
<th>Ordering code</th>
<th>Packing unit</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>650</td>
<td>6</td>
<td>55</td>
<td>35</td>
<td>30 x 55</td>
<td>33</td>
<td>73</td>
<td>2</td>
<td>B33331V7205J0#X</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>460</td>
<td>7</td>
<td>75</td>
<td>23</td>
<td>30 x 65</td>
<td>33</td>
<td>83</td>
<td>2</td>
<td>B33331V7405J0#X</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>650</td>
<td>8</td>
<td>100</td>
<td>21</td>
<td>30 x 65</td>
<td>33</td>
<td>83</td>
<td>2</td>
<td>B33331V7605J0#X</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>460</td>
<td>9</td>
<td>140</td>
<td>17</td>
<td>30 x 65</td>
<td>33</td>
<td>83</td>
<td>2</td>
<td>B33331V7805J0#X</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

$1)$ $I_{max}$ – Maximum RMS current for continuous operation defined for a hotspot of ≤ 85 °C, case temperature of ≤ 60 °C, including harmonics up to frequency of 20 kHz.

$2)$ $ESR$ – Equivalent Series resistance at 1KHz.

Please read Cautions and warnings and Important notes at the end of this document.
Composition of ordering code

#: construction
6 Aluminium can flat type
8 Aluminium can with M8 bolt

X:
0 as per this dimension and properties
1-9 special dimension and properties

Packing box

![Packing box diagram]

h=capacitor height (H) + terminal height + 10 mm min.
Rated AC voltage $V_R$
Maximum operating peak voltage of either polarity of reversing type waveform for which the capacitor is designed

![Graph of AC waveform](image)

Rated AC RMS voltage $V_{RMS}$
Root mean square of the maximum permissible value of sinusoidal AC voltage in continuous operation

Rated capacitance $C_R$
Designed capacitance of the capacitor at 20 °C at 1 kHz

Maximum continuous current $I_{max}$
Maximum RMS current for continuous operation, including harmonics
Film Capacitors - AC Capacitors  
B33331V series  
General Purpose MKP AC Capacitors  
CBB65A-1

Maximum peak current $\bar{I}$
Maximum current amplitude which occurs instantaneously during continuous operation

The maximum peak current ($\bar{I}$) and the maximum rate of voltage rise ($\frac{dV}{dT}$) of a capacitor are related as follows:

$$\bar{I} = C \left( \frac{dV}{dT} \right)_{max}$$

Maximum surge current $I_s$
Admissible peak current induced by a switching or any other disturbance of the system which is allowed for a limited number of times

$$I_s = C \left( \frac{dV}{dT} \right)_s$$

Maximum duration: 50 ms / pulse
Maximum number of occurrences: 1000 (during load)

Equivalent series resistance ESR
Effective resistance which, if connected in series with an ideal capacitor of capacitance value equal to that of the capacitor in question, would have a power loss equal to active power dissipated in that capacitor under specified operating conditions.

Self-inductance $L_{self}$
Series inductance of the terminals and the winding
With self-inductance, it is possible to determine the resonance frequency.

$$f = \frac{1}{2\pi \sqrt{L_{self} C}}$$

Harmonics
Harmonics result from the operation of electrical loads with non-linear voltage-current characteristics. It is necessary to calculate the temperature rise of the capacitors from hotspot to case during the using process. If the temperature rise of theoretical calculation of capacitor’s hotspot exceeds the maximum allowable range, we would propose to check the total harmonic current distortion (THDi) of the input terminals.

$$THD_i = \sqrt{\sum_{n=1}^{\infty} \left( \frac{I_n}{I_1} \right)^2}$$

Thermal load
After installation of the capacitor, it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

Mechanical protection
The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can are avoided.
Storage and operating conditions
Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. In dusty environments, regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground. The maximum storage temperature is 85 °C.

Service life expectancy
Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors, too. The maximum service life expectancy may vary depending on the application for which the capacitor is used.

Overpressure disconnector
To ensure full functionality of an overpressure disconnector, the following must be observed:
- The elastic elements must not be hindered, i.e.
  - connecting lines must be flexible leads (cables).
  - there must be sufficient space for expansion above the connections.
  - folding seams must not be retained by clamps.
- Stress parameters of the capacitor must be within the IEC 61071 specification.

Safety
- Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.
- Ensure good, effective grounding for capacitor enclosures.
- Observe appropriate safety precautions during operation (self-recharging phenomena and the high energy contained in capacitors).
- Handle capacitors carefully, because they may still be charged even after disconnection.
- The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- Follow good engineering practice.

Cautions and warnings
- In case of dents of more than 1 mm depth or any other mechanical damage, capacitors must not be used at all. This applies also in cases of leakage.
- To ensure the full functionality of the overpressure disconnector, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor.
- Check tightness of the connections/terminals periodically.
- The energy stored in capacitors may be lethal. To prevent any chance of shock, discharge and short-circuit the capacitor before handling.
- Failure to follow cautions may result, worst case, in premature failures, bursting and fire.
- TDK Electronics is not responsible for any kind of possible damages to persons or things due to improper installation and application of capacitors for power electronics.

Display of ordering codes for TDK Electronics products
The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products. Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.
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 we are 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 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 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 an 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 an 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)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). 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. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply.**

7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that only requirements mutually agreed upon can and will be implemented in our Quality Management System. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.
8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are trademarks registered or pending in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

Release 2018-10