Film Capacitors – Power Electronic Capacitors

PEC MKP DC

Series/Type:	**MKP DC HT (Resin top)**
Ordering code:	**B25695E***
Date:	2023-07-28
Version:	1

© TDK Electronics AG 2023. Reproduction, publication and dissemination of this publication, enclosures hereto and the information contained therein without TDK Electronics' prior express consent is prohibited.

Rated capacitance: 95 µF … 3400 µF
Rated DC Voltage: 700 V DC … 1300 V DC



Construction

- Metallized polypropylene film
- Aluminum case and resin top
- Filling material: Non-PCB hard epoxy resin (dry type)
- Diameter: 85 mm and 116 mm

Features

- Operating temperature range up to 105 °C
- Self-healing properties
- Low dissipation factor
- Naturally air cooled (or forced air cooling)
- IP00 Protection Degree (Indoor Mounting)
- Over-voltage capability
- RoHS compatible

Application

- DC link for renewable energy converters (solar, wind)
- DC link for traction applications (train, subway, tramway, light train inverters)
- DC link for industrial motor drive

Terminals

- Screw female (M6) terminals

Mounting

- Threaded bolt at the bottom of aluminum case (M12)

Packing

- 85 mm Diameter: 4 capacitors per box or
  12 capacitors per box
- 116 mm Diameter: 4 capacitors per box
- Each carton box may contain carton plates to fill the empty space.

Technical data

Rated capacitance C_R	Up to 3.4 mF
Standard capacitance tolerance	K: ±10%
Rated DC voltage $V_{R,\,DC}$	up to 85 °C: 700 … 1300 V DC
Lifetime expectancy $t_{LD\,(co)}$ [1] (refer to section 3)	100 000 h at T_{HS} +75 °C and $V_{R,\,DC}$ up to 200 000 h (Considering deratings in voltage and/or temperature upon request)
Expected failure rate $\alpha_{FQ\,(co)}$ [1]	50 FIT at $V_{R,\,DC}$ and +70 °C (refer to section 4)
Voltage derating	85 °C < T_{HS} ≤ 95 °C: derating factor 2.0% per °C for $V_{R,\,DC}$ 95 °C < T_{HS} ≤ 105 °C: derating factor 2.5% per °C for $V_{R,\,DC}$
Frequency range	100 Hz … 10 kHz for C_R ≤ 1500 µF 100 Hz … 5 kHz for 1500 µF < C_R ≤ 3000 µF 100 Hz … 3 kHz for 3000 µF < C_R ≤ 3400 µF High frequency designs available upon request Permitted I_{max} of specified frequency must be evaluated by customer
Maximum altitude	2000 m above sea level. Derating curves for altitudes higher than 2000 m available upon request
Reference standards	IEC 61071-2017, GB/T 17702-2021, RoHS
Maximum ratings	
Maximum permissible voltage (V_{max})	$V_{R,DC}$ +10% (30 % of on-load daily duration) $V_{R,DC}$ +15% (up to 30 min daily) $V_{R,DC}$ +20% (up to 5 min daily) $V_{R,DC}$ +30% (up to 1 min daily)
Test data	
Voltage test between terminals V_{TT}	1.5 $V_{R,\,DC}$, 10 s
Voltage test between terminals and case V_{TC}	4000 V AC / 10 s
Climatic data	
Climatic category	40/105/56 to IEC 60068-1 (2013)
Lower category T_{min}	−40 °C
Upper category T_{max}	+105 °C
Damp heat test	56 days 93 % RH @ 40 °C
Maximum hotspot temperature T_{HS} (see Terms)	+105 °C
Mechanical data	
Max. torque terminal Female (M6)	5 Nm
Max. torque (M12) case stud	10 Nm

[1] co: Continuous operation

1.1 Electrical characteristics

$V_{R,DC}$ = 700 V DC / $V_{C,95°C}$ = 560 V DC / $V_{C,105°C}$ = 385 V DC
V_{TT} = 1050 V DC, 10 s; V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} [2] A	I_S kA	Î kA	ESR [3] mΩ	L_{self} nH	R_{TH} K/W	ØD mm	H_C [4] mm	H_T mm	Weight [5] kg	Fig. [6]	Ordering code [7]
270	65	8.0	2.7	1.5	≤40	5.0	85	70	76	0.6	1	B25695E0277K701
450	65	8.5	2.8	1.5	≤40	5.0	85	95	101	0.8	1	B25695E0457K701
610	55	8.5	2.8	2.2	≤40	4.7	85	120	126	1.0	1	B25695E0617K701
700	80	16.0	5.3	1.2	≤40	4.3	85	151	157	1.2	1	B25695E0707K701
850	75	15.9	5.3	1.3	≤60	4.2	85	176	182	1.4	1	B25695E0857K701
900	80	17.1	5.7	0.9	≤40	5.3	116	96	102	1.3	2	B25695E0907K703
1200	75	16.7	5.6	1.2	≤40	4.9	116	121	127	1.6	2	B25695E0128K703
1430	100	33.1	11.0	0.9	≤60	3.5	116	151	157	2.0	2	B25695E0148K703
1750	100	33.2	11.1	1.0	≤60	3.3	116	176	182	2.3	2	B25695E0178K703
2370	95	33.1	11.0	1.2	≤90	3.0	116	226	232	3.0	2	B25695E0238K703
3400	110	47.4	15.8	1.1	≤90	2.5	116	331	337	4.4	2	B25695E0348K703

$V_{R,DC}$ = 900 V DC / $V_{C,95°C}$ = 720 V DC / $V_{C,105°C}$ = 495 V DC
V_{TT} = 1350 V DC, 10 s; V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} [2] A	I_S kA	Î kA	ESR [3] mΩ	L_{self} nH	R_{TH} K/W	ØD mm	H_C [4] mm	H_T mm	Weight [5] kg	Fig. [6]	Ordering code [7]
230	65	7.4	2.5	1.6	≤40	5.0	85	70	76	0.6	1	B25695E0237K901
380	65	7.8	2.6	1.6	≤40	5.0	85	95	101	0.8	1	B25695E0387K901
510	55	7.7	2.6	2.3	≤40	4.7	85	120	126	1.0	1	B25695E0517K901
580	80	14.5	4.8	1.2	≤40	4.3	85	151	157	1.2	1	B25695E0587K901
730	75	14.8	4.9	1.3	≤60	4.2	85	176	182	1.4	1	B25695E0737K901
730	80	15.0	5.0	1.0	≤40	5.3	116	96	102	1.3	2	B25695E0737K903
980	70	14.8	4.9	1.3	≤40	4.9	116	121	127	1.6	2	B25695E0987K903
1150	95	28.8	9.6	1.0	≤60	3.5	116	151	157	2.0	2	B25695E0118K903
1400	95	28.8	9.6	1.1	≤60	3.3	116	176	182	2.3	2	B25695E0148K903
1900	90	28.7	9.6	1.3	≤90	3.0	116	226	232	3.0	2	B25695E0198K903
2800	105	42.3	14.1	1.2	≤90	2.5	116	331	337	4.4	2	B25695E0288K903

[2] Please refer to section 2 (current derating) for more information.
[3] ESR at 1kHz (typical value).
[4] H_C is a typical value.
[5] Weight is a typical value.
[6] Refer to dimensional drawings on page 8.
[7] Ending K**1 for Ø 85 mm, K**3 for Ø 116 mm, other terminal configurations available upon request.

$V_{R,DC}$ = 1000 V DC / $V_{C,95°C}$ = 800 V DC / $V_{C,105°C}$ = 550 V DC
V_{TT} = 1500 V DC, 10 s; V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} [2] A	I_S kA	Î kA	ESR [3] mΩ	L_{self} nH	R_{TH} K/W	ØD mm	H_C [4] mm	H_T mm	Weight [5] kg	Fig. [6]	Ordering code [7]
180	60	6.5	2.2	1.7	≤40	5.0	85	70	76	0.6	1	B25695E1187K001
290	60	6.7	2.2	1.7	≤40	5.0	85	95	101	0.8	1	B25695E1297K001
400	55	6.8	2.3	2.4	≤40	4.7	85	120	126	1.0	1	B25695E1407K001
450	75	12.7	4.2	1.3	≤40	4.3	85	151	157	1.2	1	B25695E1457K001
570	75	13.1	4.4	1.4	≤60	4.2	85	176	182	1.4	1	B25695E1577K001
570	80	13.2	4.4	1.0	≤40	5.3	116	96	102	1.3	2	B25695E1577K003
750	70	12.8	4.3	1.4	≤40	4.9	116	121	127	1.6	2	B25695E1757K003
920	90	26.0	8.7	1.1	≤60	3.5	116	151	157	2.0	2	B25695E1927K003
1100	90	25.6	8.5	1.2	≤60	3.3	116	176	182	2.3	2	B25695E1118K003
1500	85	25.6	8.5	1.4	≤90	3.0	116	226	232	3.0	2	B25695E1158K003
2250	100	38.5	12.8	1.3	≤90	2.5	116	331	337	4.4	2	B25695E1228K003

$V_{R,DC}$ = 1100 V DC / $V_{C,95°C}$ = 880 V DC / $V_{C,105°C}$ = 605 V DC
V_{TT} = 1650 V DC, 10 s; V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} [2] A	I_S kA	Î kA	ESR [3] mΩ	L_{self} nH	R_{TH} K/W	ØD mm	H_C [4] mm	H_T mm	Weight [5] kg	Fig. [6]	Ordering code [7]
150	60	8.0	2.7	1.8	≤40	5.0	85	70	76	0.6	1	B25695E1157K101
240	60	8.2	2.7	1.8	≤40	5.0	85	95	101	0.8	1	B25695E1247K101
320	50	8.1	2.7	2.5	≤40	4.7	85	120	126	1.0	1	B25695E1327K101
380	75	15.7	5.2	1.3	≤40	4.3	85	151	157	1.2	1	B25695E1387K101
470	75	15.9	5.3	1.4	≤60	4.2	85	176	182	1.4	1	B25695E1477K101
480	75	16.4	5.5	1.1	≤40	5.3	116	96	102	1.3	2	B25695E1487K103
620	65	15.6	5.2	1.5	≤40	4.9	116	121	127	1.6	2	B25695E1627K103
770	85	32.1	10.7	1.2	≤60	3.5	116	151	157	2.0	2	B25695E1777K103
900	85	30.8	10.3	1.3	≤60	3.3	116	176	182	2.3	2	B25695E1907K103
1200	85	30.2	10.1	1.5	≤90	3.0	116	226	232	3.0	2	B25695E1128K103
1800	95	45.3	15.1	1.4	≤90	2.5	116	331	337	4.4	2	B25695E1188K103

[2] Please refer to section 2 (current derating) for more information.
[3] ESR at 1kHz (typical value).
[4] H_C is a typical value.
[5] Weight is a typical value.
[6] Refer to dimensional drawings on page 8.
[7] Ending K**1 for Ø 85 mm, K**3 for Ø 116 mm, other terminal configurations available upon request.

$V_{R,DC}$ = 1200 V DC / $V_{C,95°C}$ = 960 V DC / $V_{C,105°C}$ = 660 V DC
V_{TT} = 1800 V DC, 10 s; V_{TC} = 4000 V AC, 10 s

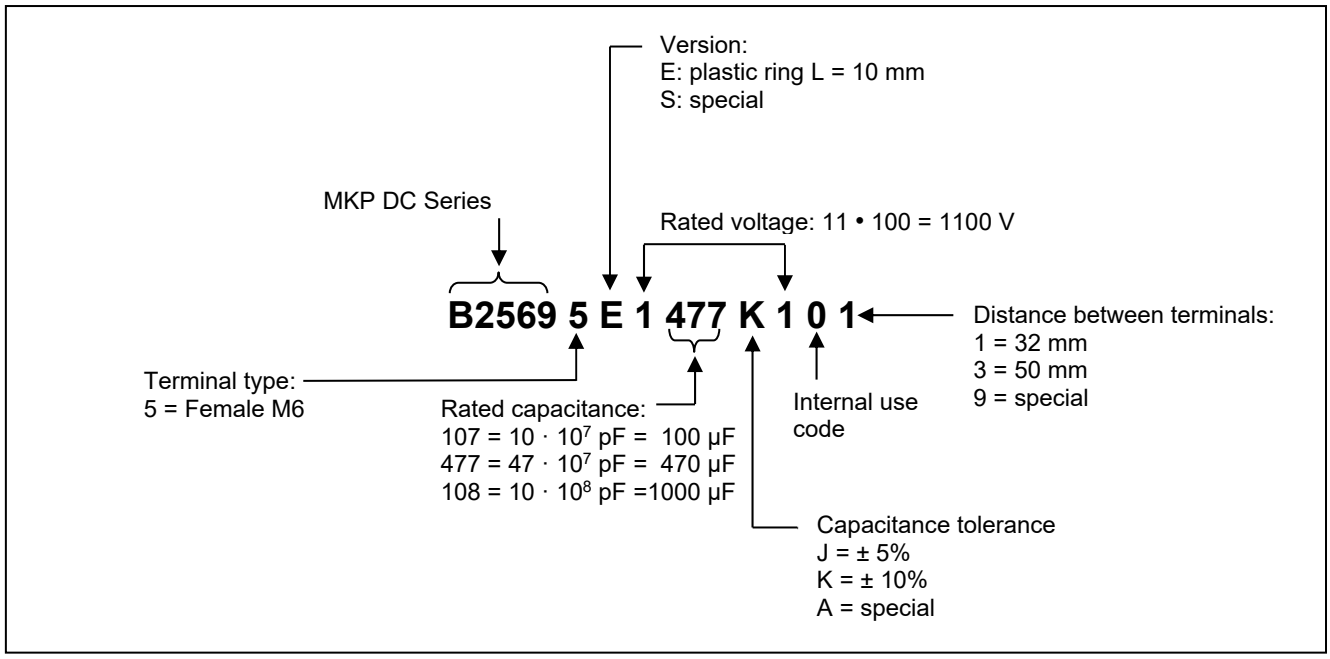
C_R µF	I_{max} [2] A	I_S kA	Î kA	ESR [3] mΩ	L_{self} nH	R_{TH} K/W	ØD mm	H_C [4] mm	H_T mm	Weight [5] kg	Fig. [6]	Ordering code [7]
110	60	6.8	2.3	1.9	≤40	5.0	85	70	76	0.6	1	B25695E1117K201
190	60	7.4	2.5	1.9	≤40	5.0	85	95	101	0.8	1	B25695E1197K201
250	50	7.2	2.4	2.6	≤40	4.7	85	120	126	1.0	1	B25695E1257K201
290	75	13.8	4.6	1.4	≤40	4.3	85	151	157	1.2	1	B25695E1297K201
350	70	13.6	4.5	1.5	≤60	4.2	85	176	182	1.4	1	B25695E1357K201
370	70	14.6	4.9	1.2	≤40	5.3	116	96	102	1.3	2	B25695E1377K203
500	65	14.5	4.8	1.6	≤40	4.9	116	121	127	1.6	2	B25695E1507K203
600	85	28.8	9.6	1.2	≤60	3.5	116	151	157	2.0	2	B25695E1607K203
720	85	28.3	9.4	1.3	≤60	3.3	116	176	182	2.3	2	B25695E1727K203
1000	85	28.9	9.6	1.5	≤90	3.0	116	226	232	3.0	2	B25695E1108K203
1400	95	40.5	13.5	1.4	≤90	2.5	116	331	337	4.4	2	B25695E1148K203

$V_{R,DC}$ = 1300 V DC / $V_{C,95°C}$ = 1040 V DC / $V_{C,105°C}$ = 715 V DC
V_{TT} = 1950 V DC, 10 s; V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} [2] A	I_S kA	Î kA	ESR [3] mΩ	L_{self} nH	R_{TH} K/W	ØD mm	H_C [4] mm	H_T mm	Weight [5] kg	Fig. [6]	Ordering code [7]
95	55	6.5	2.2	2.0	≤40	5.0	85	70	76	0.6	1	B25695E1956K301
160	55	6.9	2.3	2.0	≤40	5.0	85	95	101	0.8	1	B25695E1167K301
220	50	6.9	2.3	2.7	≤40	4.7	85	120	126	1.0	1	B25695E1227K301
240	70	12.7	4.2	1.5	≤40	4.3	85	151	157	1.2	1	B25695E1247K301
300	70	12.9	4.3	1.6	≤60	4.2	85	176	182	1.4	1	B25695E1307K301
300	70	12.9	4.3	1.3	≤40	5.3	116	96	102	1.3	2	B25695E1307K303
420	60	13.1	4.4	1.7	≤40	4.9	116	121	127	1.6	2	B25695E1427K303
500	85	26.4	8.8	1.3	≤60	3.5	116	151	157	2.0	2	B25695E1507K303
600	85	25.8	8.6	1.4	≤60	3.3	116	176	182	2.3	2	B25695E1607K303
830	80	25.9	8.6	1.6	≤90	3.0	116	226	232	3.0	2	B25695E1837K303
1250	95	39.0	13.0	1.5	≤90	2.5	116	331	337	4.4	2	B25695E1128K303

[2] Please refer to section 2 (current derating) for more information.
[3] ESR at 1kHz (typical value).
[4] H_C is a typical value.
[5] Weight is a typical value.
[6] Refer to dimensional drawings on page 8.
[7] Ending K**1 for Ø 85 mm, K**3 for Ø 116 mm, other terminal configurations available upon request.

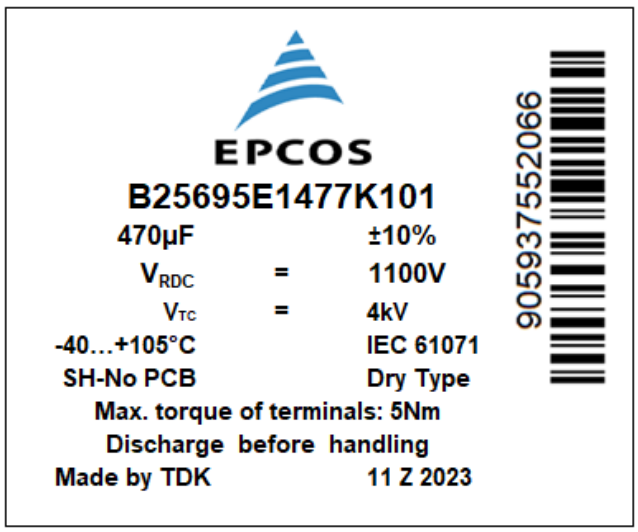
1.2 Structure of ordering code



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.

1.3 Label Information



Date code explanation (11 Z 2023)
CW Z YYYY: production week (e.g.: CW11)
CW **Z** YYYY: produced in Zhuhai (China)
CW Z **YYYY**: production year (e.g.: 2023)

Bar code explanation
Bar code consists of batch number and serial number.
Batch number: 9 digits (e.g.: 905937552)
Serial number: 3 digits (e.g.: 066)

1.4 Dimensional drawings

Figure 1: - B25695E – Ø = 85 mm
- Female terminals (M6)
- Between terminals 32 ±0.5 mm

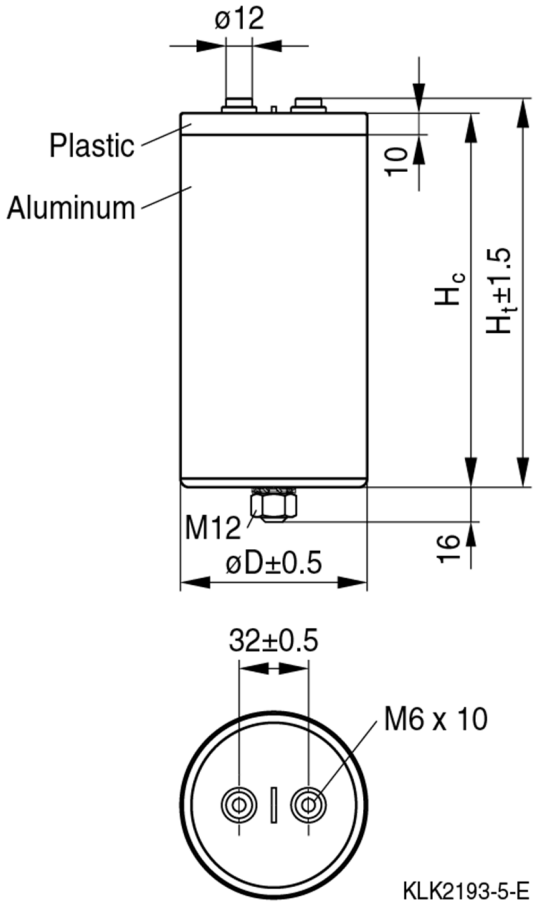
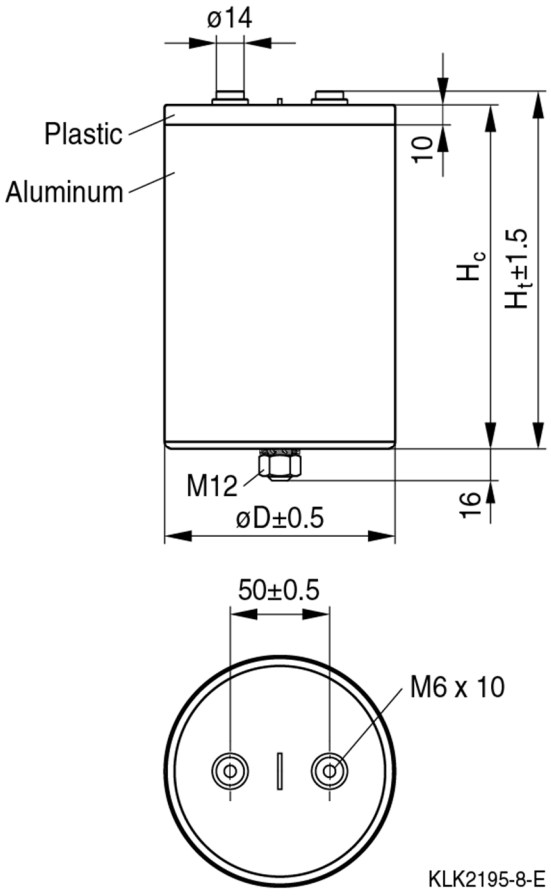


Figure 2: - B25695E – Ø = 116 mm
- Female terminals (M6)
- Between terminals 50 ±0.5 mm



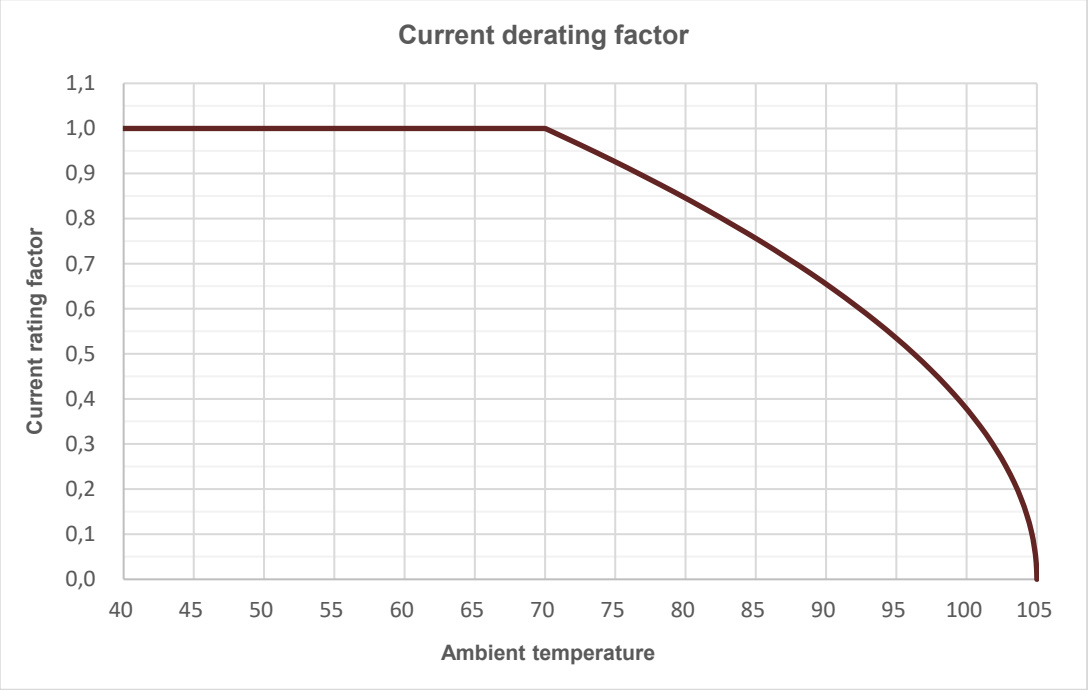
M12 stud on bottom of the aluminum case, nut (DIN 934) and toothed lock washer (DIN 6797) for fixing are standard for all types.

ØD is the diameter which close to the aluminum case bottom side about 10 mm.

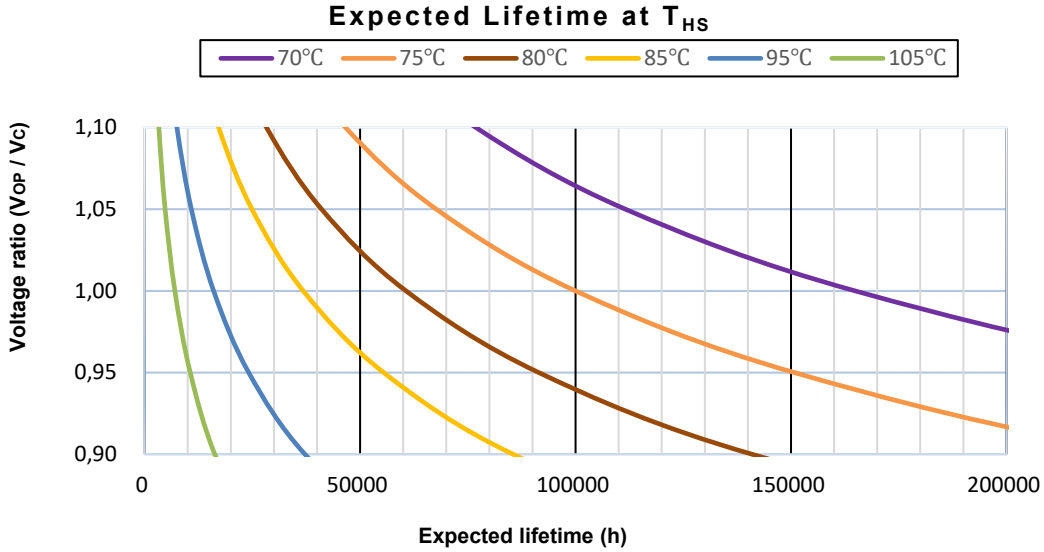
1.5 Clearance and Creepage distances (Typical value)

Diameter (Ø)	Plastic ring (L)	Terminal to Terminal		Terminal to Case	
mm	mm	Clearance mm	Creepage mm	Clearance mm	Creepage mm
85	10	20.0	27.5	30.5	32.0
116	10	36.0	43.5	36.0	37.5

2. Current derating



3. Lifetime expectancy

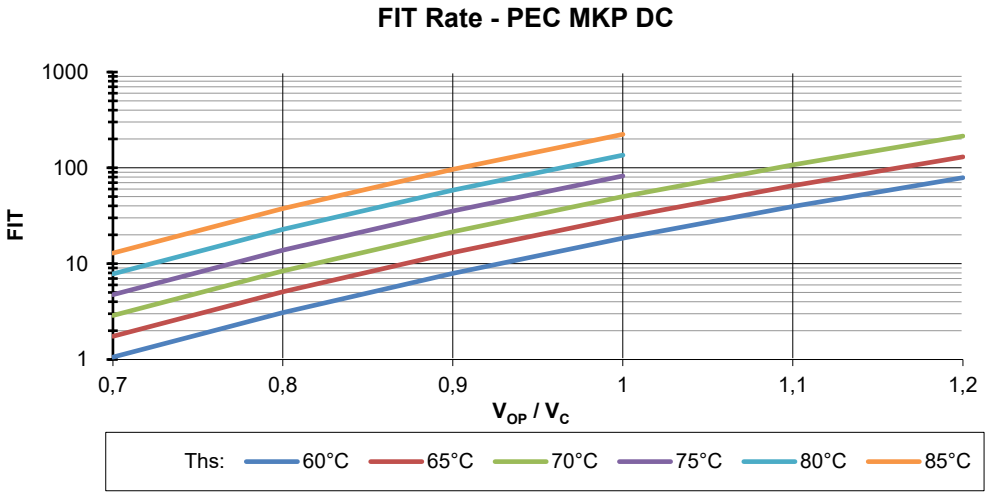


Lifetime expectancy (t_{LD}) in hours at different hotspot temperature (T_{HS}) and category voltage (V_C)

Failure criteria is capacitance drop higher than 3%.

Lifetime estimations are typical values derived from lifetime tests based on TDK internal standards or mutually agreed test methods and are intended for guidance purposes only. The useful life does not constitute a warranty of any kind or a prolongation of the agreed warranty period.

4. Expected failure rate



Expected fit rate ($\alpha_{FQ\,(co)}$) at different hot spot temperatures (T_{HS}) and category voltage V_C

The FIT (Failure In Time) of a component is defined as the number of expected failures in 10^9 hours of operation. The FIT rate is calculated based on the number of components operating in the field and the estimated hours of operation. All the reports of failures are taken into consideration for this calculation, which is updated every year.

The other values in the graph are given as indication and calculated based on acceleration factors.

Terms and characteristics

The following definitions apply to power capacitors according to IEC 61071.

Rated capacitance C_R
Nominal value of the capacitance at 20 °C and measuring frequency of 100 Hz.

Rated DC voltage $V_{R,DC}$
Maximum operating peak voltage (T_{HS} ≤85°C) of either polarity but of a non-reversing type wave form, for which the capacitor has been designed, for continuous operation.

Category voltage V_C
Maximum voltage which may be applied continuously to a capacitor at its upper category temperature (85 °C < T_{HS} ≤ 105 °C).

Operating voltage V_{OP}
The operating voltage of the capacitor.

Ripple voltage V_{ripple}
Peak-to-peak alternating component of the unidirectional voltage.

Maximum surge voltage V_S
Peak voltage induced by a switching or any other disturbance of the system which is allowed for a limited number of times and short period.

Insulation voltage V_i
RMS rated value of the insulation voltage of capacitive elements and terminals to case or earth. When it is not specified in the product data sheet, the insulation voltage is at least:

$$V_i = \frac{V_{RDC}}{\sqrt{2}}$$

AC voltage test between terminals and case V_{TC}
Units having all terminals insulated from the container shall be subjected for 10 s to a voltage applied between the terminals (joined together) and the container.

Maximum rate of voltage rise $(dV/dt)_{max}$
Maximum permissible repetitive rate of voltage rise of the operational voltage.

Maximum current I_{max}
Maximum RMS current for continuous operation for the given frequency range and for the maximum ripple voltage. Please provide Frequency Spectrum of RMS current to your sales contact.

Maximum peak current $\hat{I}$
Maximum permissible repetitive current amplitude during continuous operation.
Maximum peak current ($\hat{I}$) and maximum rate of voltage rise $(dV/dt)_{max}$ on a capacitor are related as follows:

$$\hat{I} = C \cdot (dV/dt)_{max}$$

Maximum surge current $\hat{I}_S$
Admissible peak current induced by a switching or any other disturbance of the system which is allowed for a limited number of times and short period.

$$\hat{I}_S = C \cdot (dV/dt)_S$$

Ambient temperature T_A
Temperature of the surrounding air, measured at 10 cm distance and 2/3 of the case height of the capacitor.

Lowest operating temperature $T_{op,min}$
Lowest permitted ambient temperature at which a capacitor may be energized.

Maximum operating temperature $T_{op,max}$
Highest permitted capacitor temperature during operation, i.e. temperature at the hottest point of the case.

Hot-spot temperature T_{HS}
Temperature zone inside of the capacitor at hottest spot.

$$T_{HS} = T_A + I_{RMS}^2 \cdot ESR \cdot R_{th}$$

Tangent of the loss angle of a capacitor tan δ
Ratio between the equivalent series resistance and the capacitive reactance of a capacitor at a specified sinusoidal alternating voltage, frequency and temperature.

Series resistance R_s
The sum of all Ohmic resistances occurring inside the capacitor.

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.

$$ESR = \frac{\tan\delta}{\omega \cdot C} = R_s + \frac{\tan\delta_0}{\omega \cdot C}$$

Thermal resistance R_{th}
The thermal resistance indicates by how many degrees the capacitor temperature at the hot spot rises in relation to the dissipation losses.

Maximum power loss P_{max}
Maximum permissible power dissipation for the capacitor's operation.

$$P_{max} = \frac{T_{hs} - T_A}{R_{th}}$$

Self inductance L_{self}
The sum of all inductive elements which are contained in a capacitor.

Resonance frequency f_r
The lowest frequency at which the impedance of the capacitor becomes minimum.

$$f_r = \frac{1}{2\pi \cdot \sqrt{L_{self} \cdot C_R}}$$

General

- In case of dents of more than 1 mm depth or any other mechanical damage, capacitors must not be used at all.
- 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, in premature failures, bursting and fire in the worst case.
- Protect the capacitor properly against over current and short circuit.
- 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.

Safety

- Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result if the capacitor should burst or from melted material expulsion due to a capacitor´s mechanical disruption.
- 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 capacitor´s terminals, connected bus bars and cables as well as other devices may also be energized.
- Follow good engineering practice.
- When power capacitors are used, suitable measures must always be taken to eliminate possible danger to humans, animals and property both during operation and when a failure occurs. This applies to capacitors both with and without protective devices. Regular inspection and maintenance by a competent person is therefore essential.

Thermal load

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

Installation

Capacitors must be installed in a cool and well ventilated place, and not close to objects that radiate heat, or in the direct sunlight. Within high-power inverter systems the capacitors usually produce the smallest portion of the total losses, and the permissible operating temperatures are low compared to power semiconductors, reactors and resistors. So, the distance between capacitor and heating sources must be large enough to avoid the capacitor overheating. In case of space constraint to make the best possible use of capacitors, technically and economically, it is advisable to supply forced cooling air.

Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum case be avoided.

Connecting

Ensure firm fixing of terminals, fixing torque to be applied as per individual specification.

In any case, the maximum specified terminal current may not be exceeded. Please refer to the

technical data of the specific series.

Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm.

Maintenance recommendation

Disregarding the following measures may result in severe operation failures, bursting and fire:

- Check tightness of the connections/terminals periodically.
- Clean the terminals/bushings periodically to avoid short circuits due dust or other contamination.
- Ensure the current does not exceed the limit.
- In case of a current above the nominal current check your application for modification.
- Check the temperature of energized capacitors. In case of excessive temperature of individual capacitors, it is recommended to replace this capacitor, as this could be an indication for loss factor increase, which is a sign for reaching end of life.

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.

Lifetime expectancy

As a rule, TDK Electronics is unfamiliar with individual customer applications or less familiar with them than the customers themselves. The results will not contain the various influences which might occur in respect to TDK products, when TDK products will be incorporated into the customer application. For these reasons, it is ultimately incumbent on the customer to check and decide whether an TDK product with the properties described in the product specification is suitable for use in a particular customer application.

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.

Handling

Discharge and short circuit the capacitor before handling! When handling the capacitor, do not take the capacitor from the terminal. This can cause accidents in case the capacitor is charged and additionally the terminal could break.

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.

Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, FilterCap, FormFit, InsuGate, LeaXield, MediPlas, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap 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 2023-07