Film Capacitors - Power Electronic Capacitors

PEC MKP DC

Series/Type:	**MKP DC High Density (Resin top)**
Ordering code:	**B25694M**
Date:	January 2026
Version:	1

Rated capacitance: 180 µF … 2305 µF
Rated DC Voltage: 900 V DC … 1600 V DC

Construction

- Metallized polypropylene film
- Aluminum case and resin top
- Filling material: Non-PCB hard polyurethane resin (dry type)
- Diameter: 85 mm, 100 mm, 116 mm

Features

- Operating temperature range up to +85 °C
- Self-healing properties
- Low dissipation factor
- Naturally air cooled (or forced air cooling)
- IP00 Protection Degree (Indoor Mounting)
- Over-voltage capability
- RoHS compatible
- UL 810 certified, file No. E502394

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: 12 capacitors per box
- 100/116 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 2.3 mF
Standard capacitance tolerance	K: ±10%
Rated DC voltage $V_{R,\ DC}$	900 … 1600 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)
Maximum altitude	2000 m above sea level. Derating curves for altitudes higher than 2000 m available upon request
Smoke and fire compliant with EN 45545 (external materials: black resin, plastic ring, plastic deck)	HL1 (R22), HL2 (R23) HL2 (R22) and HL3 (R23) Hazard Level Classification are available upon request, but require investment in new tooling
Reference standards	IEC 61071-2017, GB/T 17702-2021, RoHS, UL 810-5th
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	40/85/56
Lower category T_{min}	−40 °C
Upper category T_{max}	+85 °C
Damp heat test	56 days 93 % RH @ 40 °C
Maximum hotspot temperature T_{HS} (see Terms)	+85 °C
Mechanical data	
Max. torque terminal	5 Nm for female M6
Max. torque (M12) case stud	10 Nm

[1] co: Continuous operation

1.1 Electrical characteristics

$V_{R,\,DC}$ = 900 V DC / V_{TT} = 1350 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max}[2) A, 60°C	I_{max}[3) A, 70°C	$\hat{I}_S$ kA	$\hat{I}$ kA	ESR[4) mΩ	L_{self}[5) nH	R_{th}[6) K/W	ØD mm	H_c[7) mm	H_t mm	Weight[8) Kg	Fig.[9)	Ordering code
560	81	63	16.0	5.3	0.9	60	3.8	85	136	142	0.85	1	B25694M0567K901
700	83	64	17.0	5.7	0.9	55	3.7	85	151	157	0.95	1	B25694M0707K901
710	83	64	16.8	5.6	0.9	50	3.6	85	154	160	1	1	B25694M0717K901
780	80	62	16.1	5.4	1.02	70	3.4	85	176	182	1.1	1	B25694M0787K901
810	99	76	23.2	7.7	0.78	70	2.9	100	136	142	1.2	2	B25694M0817K901
950	99	76	23.1	7.7	0.81	60	2.8	100	154	160	1.35	2	B25694M0957K901
1050	78	60	16.0	5.3	1.23	80	3.0	85	226	232	1.4	1	B25694M0118K901
1125	97	75	23.2	7.7	0.88	75	2.7	100	176	182	1.5	2	B25694M0118K911
1130	116	90	32.3	10.8	0.7	75	2.3	116	136	142	1.6	3	B25694M0118K903
1325	116	90	32.3	10.8	0.73	65	2.3	116	154	160	1.8	3	B25694M0138K903
1520	95	73	23.2	7.7	1.05	90	2.3	100	226	232	1.9	2	B25694M0158K901
1565	114	88	32.2	10.7	0.8	85	2.1	116	176	182	2.1	3	B25694M0168K903
2115	112	87	32.3	10.8	0.95	65	1.9	116	226	232	2.6	3	B25694M0218K903
2305	120	115	47.5	15.8	0.67	75	1.5	116	255	261	2.9	3	B25694M0238K903

$V_{R,\,DC}$ = 1000 V DC / V_{TT} = 1500 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max}[2) A, 60°C	I_{max}[3) A, 70°C	$\hat{I}_S$ kA	$\hat{I}$ kA	ESR[4) mΩ	L_{self}[5) nH	R_{th}[6) K/W	ØD mm	H_c[7) mm	H_t mm	Weight[8) Kg	Fig.[9)	Ordering code
450	79	61	14.5	4.8	0.96	50	3.8	85	136	142	0.85	1	B25694M1457K001
530	79	61	14.5	4.8	0.98	65	3.6	85	154	160	1	1	B25694M1537K001
630	78	60	14.6	4.9	1.08	55	3.4	85	176	182	1.1	1	B25694M1637K001
650	96	74	20.9	7.0	0.82	55	2.9	100	136	142	1.2	2	B25694M1657K001
765	97	75	20.9	7.0	0.84	70	2.8	100	154	160	1.35	2	B25694M1777K001
850	76	58	14.5	4.8	1.29	65	3.0	85	226	232	1.4	1	B25694M1857K001
905	114	88	29.2	9.7	0.73	60	2.3	116	136	142	1.6	3	B25694M1917K003
910	95	73	21.0	7.0	0.93	60	2.7	100	176	182	1.5	2	B25694M1917K001
1065	114	88	29.1	9.7	0.76	80	2.3	116	154	160	1.8	3	B25694M1118K003
1230	93	72	21.0	7.0	1.1	70	2.3	100	226	232	1.9	2	B25694M1128K001
1265	112	86	29.2	9.7	0.83	70	2.1	116	176	182	2.1	3	B25694M1138K003
1710	110	85	29.2	9.7	0.99	80	1.9	116	226	232	2.6	3	B25694M1178K003
1860	120	113	43.0	14.3	0.69	75	1.5	116	255	261	2.9	3	B25694M1198K003

[2/3)] $I_{max.}$ is the typical value calculated for nominal value at 1 kHz, assuming:
- Ambient temperature at +70 °C for T_{HS} ≤ +85 °C, ΔT_{max} ≤ 15 K.
- Ambient temperature at +60 °C for T_{HS} ≤ +85 °C, ΔT_{max} ≤ 25 K.
- Natural convection (10 W/m^{2}K) Thermal resistance ambient to HS, considering natural convection (10 W/(m^{2}K)), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia. For the details, please refer to section 2 (***current derating***).

[4/5)] ESR is a typical value at 1 kHz. L_{self} is a typical value at resonance frequency

[6)] R_{th} ambient to HS, considering natural convection (10 W/m^{2}K), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia.

[7/8)] H_C is a typical value. Weight is a typical value.

[9)] Refer to dimensional drawings on page 9 and 10.

Other configurations and capacitance tolerances are available upon request.

$V_{R,\,DC}$ = 1100 V DC / V_{TT} = 1650 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} 2) A, 60°C	I_{max} 3) A, 70°C	$\hat{I}_S$ kA	$\hat{I}$ kA	ESR 4) mΩ	L_{self} 5) nH	R_{th} 6) K/W	ØD mm	H_c 7) mm	H_t mm	Weight 8) kg	Fig. 9)	Ordering code
370	76	59	17.5	5.8	1.02	60	3.8	85	136	142	0.85	1	B25694M1377K101
435	77	59	17.5	5.8	1.04	50	3.6	85	154	160	1	1	B25694M1447K101
520	75	58	17.6	5.9	1.14	65	3.4	85	176	182	1.1	1	B25694M1527K101
535	94	72	25.3	8.4	0.86	65	2.9	100	136	142	1.2	2	B25694M1547K101
635	95	73	25.5	8.5	0.88	55	2.8	100	154	160	1.35	2	B25694M1647K101
705	74	57	17.6	5.9	1.37	75	3.0	85	226	232	1.4	1	B25694M1717K101
750	111	86	35.4	11.8	0.76	75	2.3	116	136	142	1.6	3	B25694M1757K103
750	93	71	25.4	8.5	0.97	75	2.7	100	176	182	1.5	2	B25694M1757K101
880	112	86	35.3	11.8	0.79	60	2.3	116	154	160	1.8	3	B25694M1887K103
1015	91	70	25.4	8.5	1.16	85	2.3	100	226	232	1.9	2	B25694M1108K101
1045	110	85	35.4	11.8	0.86	80	2.1	116	176	182	2.1	3	B25694M1108K103
1415	108	83	35.4	11.8	1.02	95	1.9	116	226	232	2.6	3	B25694M1148K103
1540	120	111	52.2	17.4	0.71	55	1.5	116	255	261	2.9	3	B25694M1158K103

$V_{R,\,DC}$ = 1200 V DC / V_{TT} = 1800 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

305	74	57	15.9	5.3	1.09	45	3.8	85	136	142	0.85	1	B25694M1317K201
360	75	58	16.0	5.3	1.11	60	3.6	85	154	160	1	1	B25694M1367K201
425	73	56	15.9	5.3	1.22	50	3.4	85	176	182	1.1	1	B25694M1437K201
440	91	70	23.0	7.7	0.91	50	2.9	100	136	142	1.2	2	B25694M1447K201
520	92	71	23.0	7.7	0.93	65	2.8	100	154	160	1.35	2	B25694M1527K201
575	71	55	15.9	5.3	1.45	60	3.0	85	226	232	1.4	1	B25694M1587K201
610	109	84	31.8	10.6	0.8	55	2.3	116	136	142	1.6	3	B25694M1617K203
615	90	70	23.0	7.7	1.02	55	2.7	100	176	182	1.5	2	B25694M1627K201
720	109	84	31.9	10.6	0.82	75	2.3	116	154	160	1.8	3	B25694M1727K203
835	89	68	23.1	7.7	1.21	65	2.3	100	226	232	1.9	2	B25694M1847K201
855	107	83	32.0	10.7	0.9	65	2.1	116	176	182	2.1	3	B25694M1867K203
1160	106	82	32.1	10.7	1.06	75	1.9	116	226	232	2.6	3	B25694M1128K203
1260	120	109	47.1	15.7	0.74	70	1.5	116	255	261	2.9	3	B25694M1138K203

2/3) $I_{max.}$ is the typical value calculated for nominal value at 1 kHz, assuming:
- Ambient temperature at +70 °C for $T_{HS} \leq$ +85 °C, $\Delta T_{max} \leq$ 15 K.
- Ambient temperature at +60 °C for $T_{HS} \leq$ +85 °C, $\Delta T_{max} \leq$ 25 K.
- Natural convection (10 W/m^{2}K) Thermal resistance ambient to HS, considering natural convection (10 W/(m^{2}K)), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia. For the details, please refer to section 2 (***current derating***).

4/5) ESR is a typical value at 1 kHz. L_{self} is a typical value at resonance frequency

6) R_{th} ambient to HS, considering natural convection (10 W/m^{2}K), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia.

7/8) H_C is a typical value. Weight is a typical value.

9) Refer to dimensional drawings on page 9 and 10.

Other configurations and capacitance tolerances are available upon request.

$V_{R, DC}$ = 1300 V DC / V_{TT} = 1950 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max}[2] A, 60°C	I_{max}[3] A, 70°C	$\hat{I}_S$ kA	$\hat{I}$ kA	ESR[4] mΩ	L_{self}[5] nH	R_{th}[6] K/W	ØD mm	H_c[7] mm	H_t mm	Weight[8] kg	Fig.[9]	Ordering code
255	71	55	14.5	4.8	1.17	55	3.8	85	136	142	0.85	1	B25694M1267K301
300	72	56	14.5	4.8	1.18	45	3.6	85	154	160	1	1	B25694M1307K311
355	71	55	14.5	4.8	1.3	60	3.4	85	176	182	1.1	1	B25694M1367K301
370	89	68	21.0	7.0	0.96	60	2.9	100	136	142	1.2	2	B25694M1377K301
435	90	69	21.0	7.0	0.98	50	2.8	100	154	160	1.35	2	B25694M1447K301
485	69	54	14.6	4.9	1.54	70	3.0	85	226	232	1.4	1	B25694M1497K301
515	106	82	29.3	9.8	0.83	65	2.3	116	136	142	1.6	3	B25694M1527K303
515	88	68	21.0	7.0	1.08	65	2.7	100	176	182	1.5	2	B25694M1527K301
605	107	83	29.2	9.7	0.86	55	2.3	116	154	160	1.8	3	B25694M1617K303
700	87	67	21.1	7.0	1.27	80	2.3	100	226	232	1.9	2	B25694M1707K301
720	105	81	29.3	9.8	0.94	75	2.1	116	176	182	2.1	3	B25694M1727K303
975	104	80	29.4	9.8	1.11	90	1.9	116	226	232	2.6	3	B25694M1987K303
1060	120	108	43.2	14.4	0.76	50	1.5	116	255	261	2.9	3	B25694M1118K303

$V_{R, DC}$ = 1500 V DC / V_{TT} = 2250 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max}[2] A, 60°C	I_{max}[3] A, 70°C	$\hat{I}_S$ kA	$\hat{I}$ kA	ESR[4] mΩ	L_{self}[5] nH	R_{th}[6] K/W	ØD mm	H_c[7] mm	H_t mm	Weight[8] kg	Fig.[9]	Ordering code
215	69	53	13.5	4.5	1.23	50	3.8	85	136	142	0.85	1	B25694M1227K501
255	70	54	13.5	4.5	1.24	45	3.6	85	154	160	1	1	B25694M1267K501*
300	69	53	13.4	4.5	1.37	55	3.4	85	176	182	1.1	1	B25694M1307K501
310	86	67	19.4	6.5	1.01	55	2.9	100	136	142	1.2	2	B25694M1317K501
365	88	67	19.4	6.5	1.03	50	2.8	100	154	160	1.35	2	B25694M1377K501
410	68	52	13.5	4.5	1.62	70	3.0	85	226	232	1.4	1	B25694M1417K501
430	104	80	27.0	9.0	0.87	50	2.3	116	136	142	1.6	3	B25694M1437K503
435	86	66	19.4	6.5	1.13	65	2.7	100	176	182	1.5	2	B25694M1447K501
510	105	81	27.1	9.0	0.89	55	2.3	116	154	160	1.8	3	B25694M1517K503
595	85	65	19.6	6.5	1.33	60	2.3	100	226	232	1.9	2	B25694M1607K501
610	104	80	27.3	9.1	0.97	55	2.1	116	176	182	2.1	3	B25694M1617K503
825	102	79	27.1	9.0	1.15	65	1.9	116	226	232	2.6	3	B25694M1837K503
895	120	106	40.0	13.3	0.78	50	1.5	116	255	261	2.9	3	B25694M1907K503

[2/3] $I_{max.}$ is the typical value calculated for nominal value at 1 kHz, assuming:
- Ambient temperature at +70 °C for T_{HS} ≤ +85 °C, ΔT_{max} ≤ 15 K.
- Ambient temperature at +60 °C for T_{HS} ≤ +85 °C, ΔT_{max} ≤ 25 K.
- Natural convection (10 W/m^{2}K) Thermal resistance ambient to HS, considering natural convection (10 W/(m^{2}K)), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia.
  For the details, please refer to section 2 (***current derating***).

[4/5] ESR is a typical value at 1 kHz. L_{self} is a typical value at resonance frequency.

[6] R_{th} ambient to HS, considering natural convection (10 W/m^{2}K), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia.

[7/8] H_C is a typical value. Weight is a typical value.

[9] Refer to dimensional drawings on page 9 and 10.

Other configurations and capacitance tolerances are available upon request.

*** This ordering code is affected by "Dual Use" regulations according to Export Control law. Dual-use number is 3A201A1. Deliveries of such products are subject to prior approval by Export Control authorities based on customer declarations. The delivery to certain countries might be restricted.**

$V_{R, DC}$ = 1600 V DC / V_{TT} = 2400 V DC, 10 s / V_{TC} = 4000 V AC, 10 s

C_R µF	I_{max} 2) A, 60°C	I_{max} 3) A, 70°C	$\hat{I}_S$ kA	$\hat{I}$ kA	ESR 4) mΩ	L_{self} 5) nH	R_{th} 6) K/W	ØD mm	H_c 7) mm	H_t mm	Weight 8) Kg	Fig. 9)	Ordering code
180	67	52	12.3	4.1	1.33	45	3.8	85	136	142	0.85	1	B25694M1187K601*
210	68	52	12.2	4.1	1.34	55	3.6	85	154	160	1	1	B25694M1217K611
255	67	52	12.4	4.1	1.45	55	3.4	85	176	182	1.1	1	B25694M1267K601
260	84	65	17.8	5.9	1.07	55	2.9	100	136	142	1.2	2	B25694M1267K611
310	85	66	18.0	6.0	1.08	55	2.8	100	154	160	1.35	2	B25694M1317K601
345	66	51	12.4	4.1	1.72	65	3.0	85	226	232	1.4	1	B25694M1357K601
360	101	78	24.6	8.2	0.92	50	2.3	116	136	142	1.6	3	B25694M1367K603
365	84	65	17.8	5.9	1.19	60	2.7	100	176	182	1.5	2	B25694M1377K601
430	103	79	24.9	8.3	0.93	50	2.3	116	154	160	1.8	3	B25694M1437K603
500	83	64	17.9	6.0	1.4	55	2.3	100	226	232	1.9	2	B25694M1507K601
510	101	78	24.9	8.3	1.01	55	2.1	116	176	182	2.1	3	B25694M1517K603
695	100	77	24.9	8.3	1.2	65	1.9	116	226	232	2.6	3	B25694M1707K603
750	120	104	36.6	12.2	0.82	45	1.5	116	255	261	2.9	3	B25694M1757K603*

2/3) $I_{max.}$ is the typical value calculated for nominal value at 1 kHz, assuming:
- Ambient temperature at +70 °C for $T_{HS} \leq$ +85 °C, $\Delta T_{max} \leq$ 15 K.
- Ambient temperature at +60 °C for $T_{HS} \leq$ +85 °C, $\Delta T_{max} \leq$ 25 K.
- Natural convection (10 W/m^{2}K) Thermal resistance ambient to HS, considering natural convection (10 W/(m^{2}K)), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia.
  For the details, please refer to section 2 (***current derating***).

4/5) ESR is a typical value at 1 kHz. L_{self} is a typical value at resonance frequency.

6) R_{th} ambient to HS, considering natural convection (10 W/m^{2}K), terminals without temperature fixation and bottom screw connected to a piece with big thermal inertia.

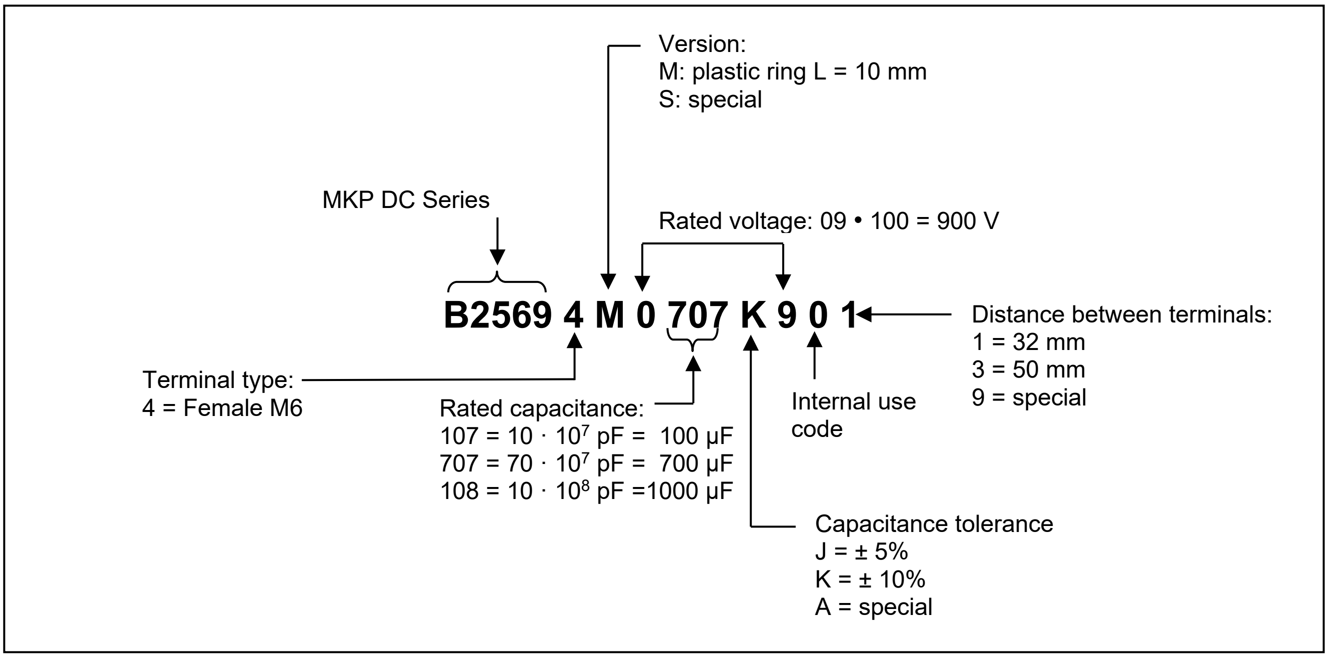
7/8) H_C is a typical value. Weight is a typical value.

9) Refer to dimensional drawings on page 9 and 10.

Other configurations and capacitance tolerances are available upon request.

*** This ordering code is affected by "Dual Use" regulations according to Export Control law. Dual-use number is 3A201A1. Deliveries of such products are subject to prior approval by Export Control authorities based on customer declarations. The delivery to certain countries might be restricted.**

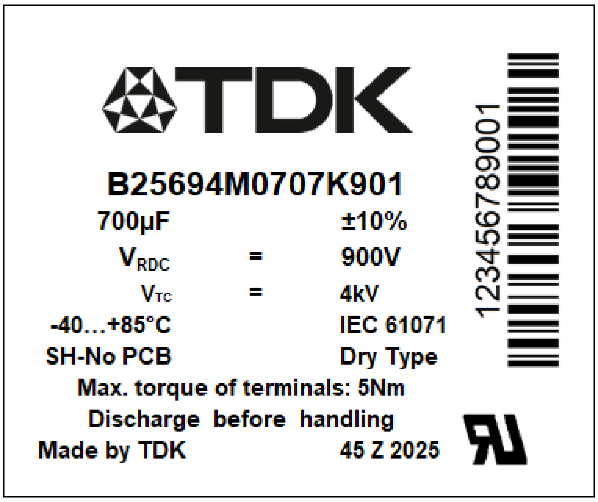
1.2 Structure of ordering code



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 (45 Z 2025)
CW Z YYYY: production week (e.g.: CW45)
CW **Z** YYYY: produced in Zhuhai (China)
CW Z **YYYY**: production year (e.g.: 2025)

Bar code explanation
Bar code consists of batch number and serial number.
Batch number: 9 digits (e.g.: 123456789)
Serial number: 3 digits (e.g.: 001)

1.4 Dimensional drawings

Figure 1: - B25694M – ØD = 85 mm
- Female terminals (M6)
- Between terminals 32 ±0.5 mm

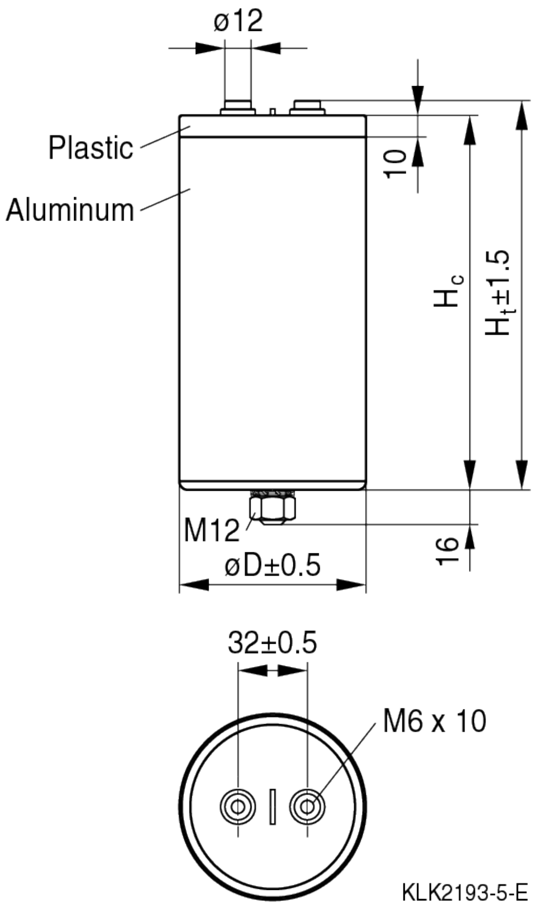
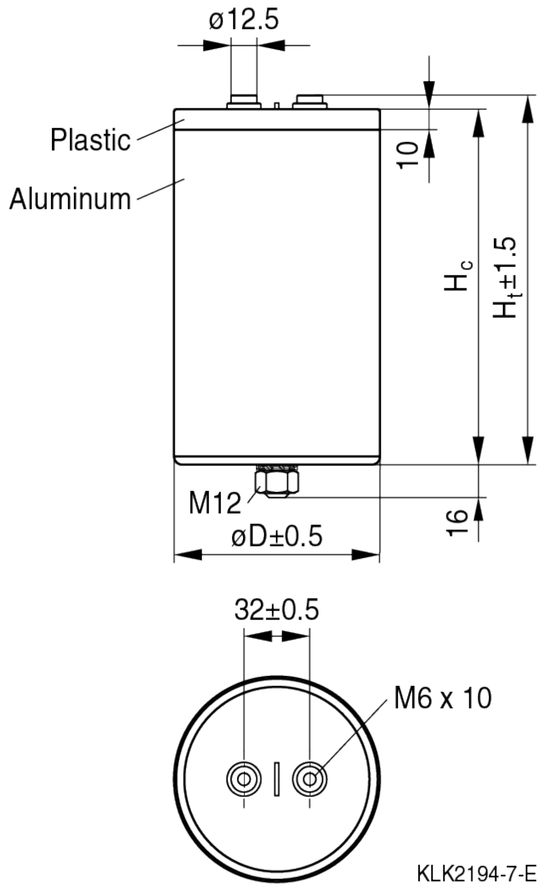


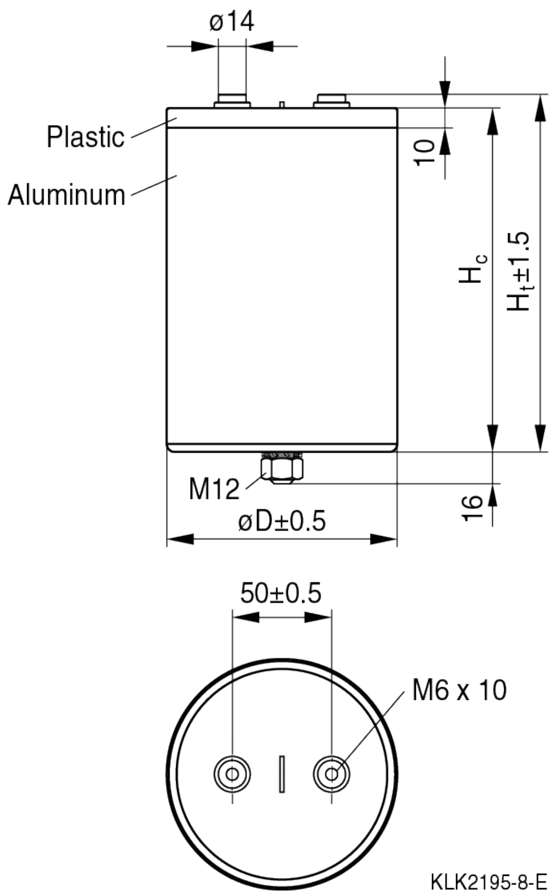
Figure 2: - B25694M – ØD = 100 mm
- Female terminals (M6)
- Between terminals 32 ±0.5 mm



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.

Figure 3: - B25694M – ØD = 116 mm
- Female terminals (M6)
- Between terminals 50 ±0.5 mm



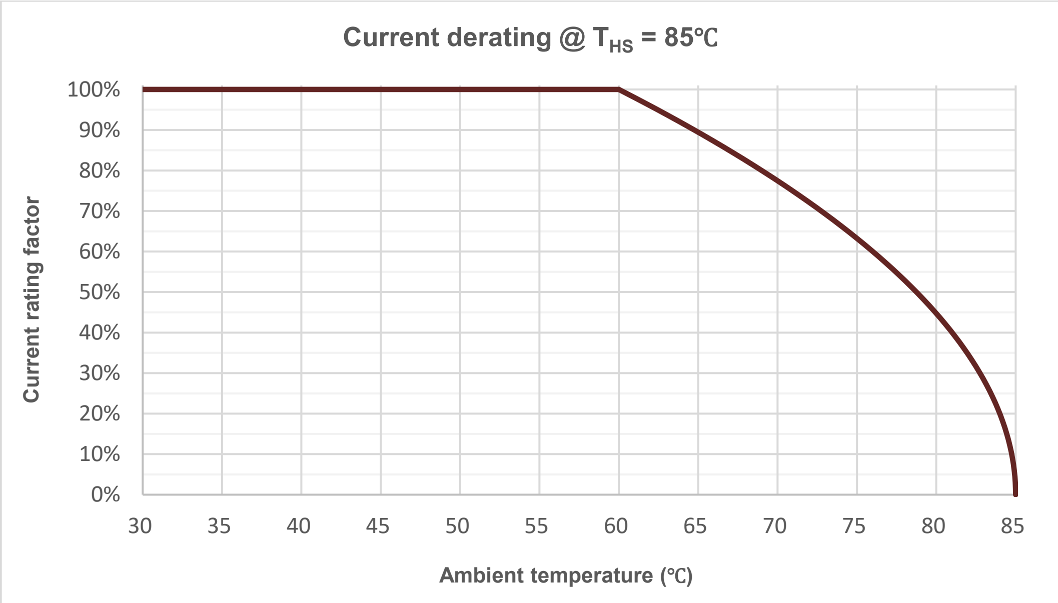
M12 stud on bottom of the aluminum case, nut (DIN 934) and toothed lock washer (DIN 6797) for fixing are standard for all types.
ØD is the diameter which close to the aluminum case bottom side about 10 mm.

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
100	10	19.5	27.0	37.5	39.0
116	10	36.0	43.5	36.0	37.5

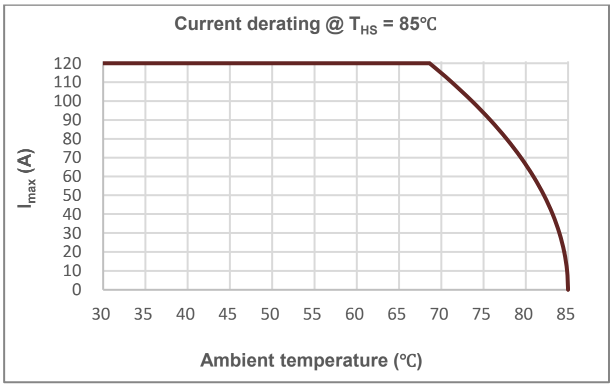
2. Current derating

2.1 Current derating curve (for the types with $I_{max, 60°C}$ < 120A)

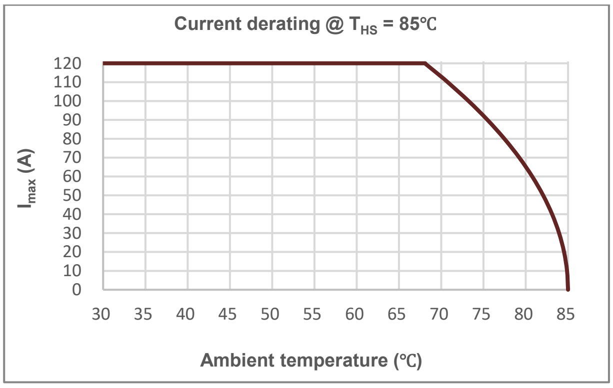


2.2 Current derating curve (for the types with $I_{max, 60°C}$ = 120A)

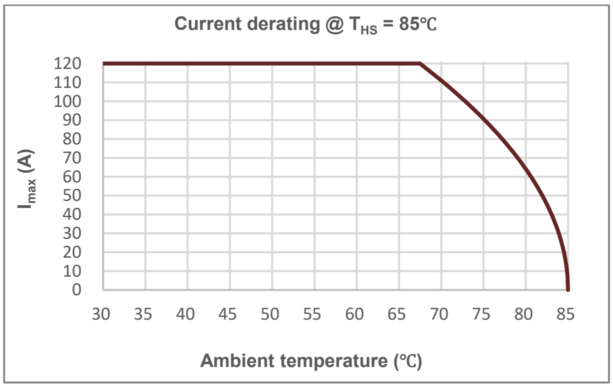
B25694M0238K903



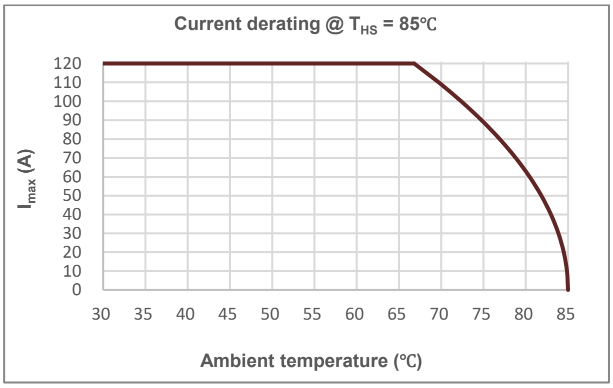
B25694M1198K003



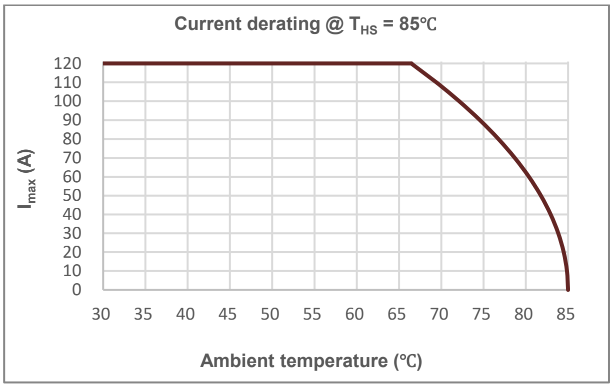
B25694M1158K103



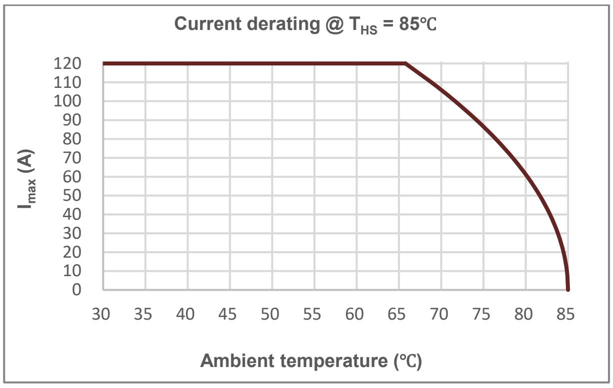
B25694M1138K203



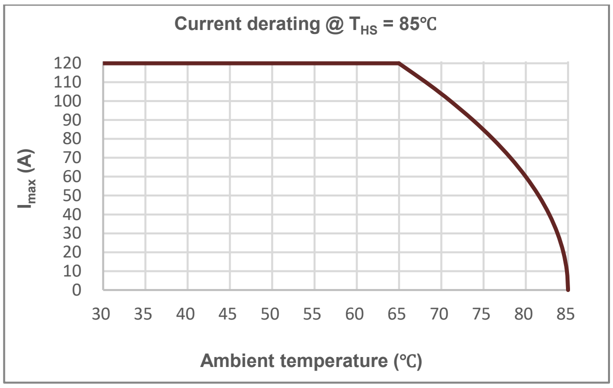
B25694M1118K303



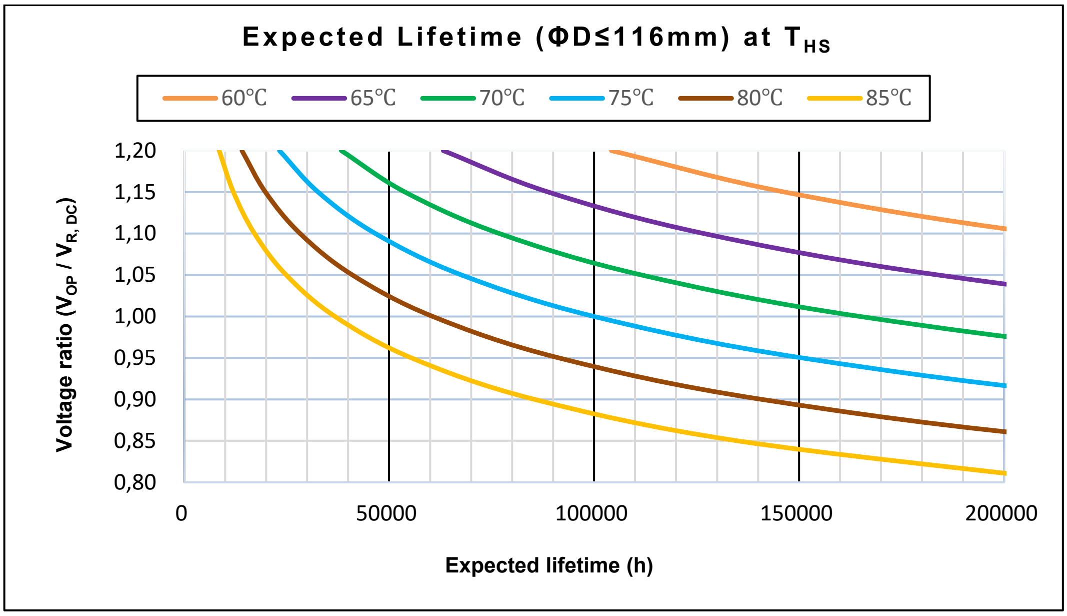
B25694M1907K503



B25694M1757K603



3. Lifetime expectancy

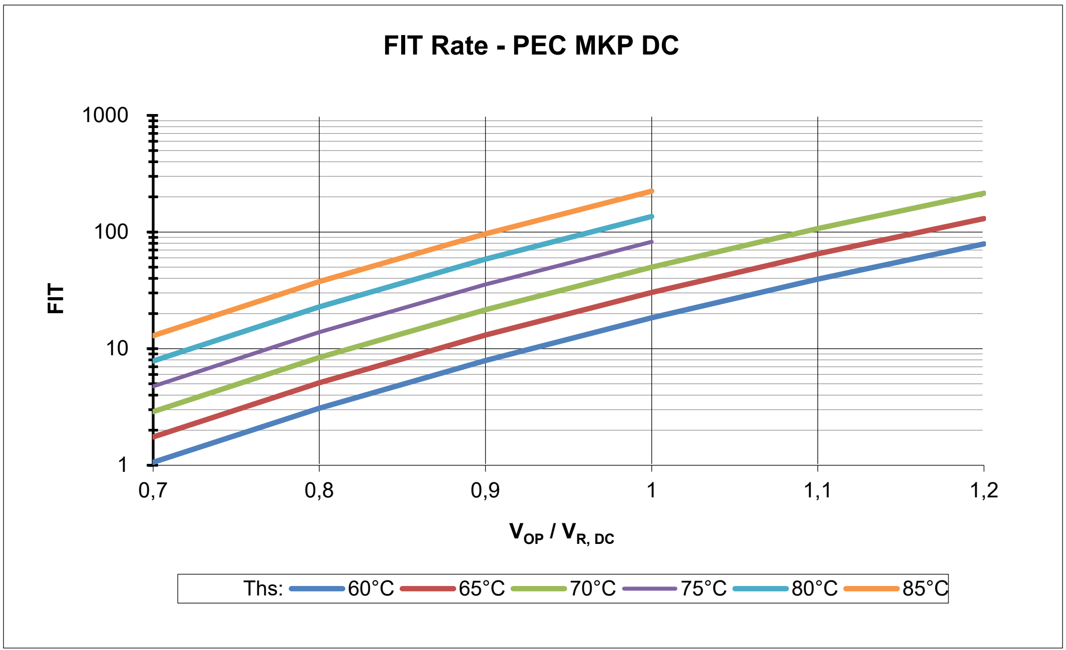


Lifetime expectancy (t_{LD}) in hours at different hotspot temperature (T_{HS}) and voltage $V_{R, DC}$

Failure criteria is capacitance drop higher than 3%.

Lifetime estimations are typical theoretical 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 voltage $V_{R,\ DC}$

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 of either polarity but of a non-reversing type wave form, for which the capacitor has been designed, for continuous operation.

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 Î
Maximum permissible repetitive current amplitude during continuous operation.
Maximum peak current (Î) 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.

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

Cautions and Warnings

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, do not handle the capacitor before it is discharged.
- 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 metal 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. In case, capacitor with plastic case, this is not applicable. Ensure the tightening torque does not exceed the limit.

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.

- Capacitors should not be stored in high temperatures and/or high humidity for long time, we recommend the following storage conditions:
  - temperature between -40°C ~ 40°C
  - humidity <= 80% RH as average per year
- Storage should not exceed 2 years (from datecode printed on the capacitor). After 1 year of storage time, capacitors must be checked electrically.

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 a 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

Do not handle the capacitor before it is discharged! 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, PiezoBrush, PlasmaBrush, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SurfIND, 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 2024-02