Film Capacitors – Power Factor Correction

DeltaCap Capacitors

Series/Type:	**MKDxxx-D-xx**
Ordering code:	**B32303A****A***/ B32304A****A***/ B32304A****B***
Date:	October 2019
Version:	13

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Construction

- Dielectric: Polypropylene film
- Non PCB, Semi-dry biodegradable resin
- Stacked winding
- Extruded round aluminum can with stud
- B32304 provided with integrated or pluggable discharge resistors



Features

- Three-phase, internal delta connection
- Double safety system:
  - overpressure disconnector
  - self healing technology
- Naturally air cooled (or forced air cooling)
- Indoor mounting

Typical applications

- For Power Factor Correction

Terminals

- Screw terminals - B32304A* series
- Fast-on terminals - B32303A* series

Mounting

- Threaded stud at bottom of can (max. torque for M12 = 10 Nm)

Technical data and specifications

Characteristics	
Rated capacitance C_R	According to specification table
Tolerance	-5/+10%
Connection	D (Delta)
Rated voltage V_R	According to specification table
Rated frequency f_R	50 and 60 Hz
Output	According to specification table
Rated current I_R	According to specification table

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Maximum ratings	
V_{max}	V_R + 10 % (up to 8 h daily) / V_R + 15 % (up to 30 min daily) / V_R + 20 % (up to 5 min daily) / V_R + 30 % (up to 1 min daily)
I_{max}	Up to 1.5 o I_R (A) (including combined effects of harmonics, overvoltages and capacitance tolerance)
I_S	Up to 200 o I_R (A)
Power dissipation*	≤ 0.2 W/kvar (dielectric) and ≤ 0.45 W / kvar (total)

* Without discharge resistor

Test data	
V_{TT}	2.15 o V_R, 2 s
V_{TC}	3000 V AC, 10 s
*tan δ (50 Hz)	≤ 1.0 o 10^{-3}

* Without discharge resistor

Climatic category -40/D	
T_{min}	-40 °C
T_{max}	+55 °C
Storage temperature	-40 … +85 °C
$T_{max\ Hotspot}$	+85 ºC
Humidity	Av. rel. < 95%
Degree of protection	IP20
Maximum altitude	4000 m

Mean life expectancy	
t_{LD}	Up to 150 000 hours at temperature class -40/C Up to 115 000 hours at temperature class -40/D
Max. 5000 switchings per year acc. to IEC 60831	

Design data	
Dimensions (d × h)	According to specification table
Weight approx.	According to specification table
Impregnation	Non PCB, resin filling: soft biodegradable polyurethane resin
Fixing	Threaded bolt M12
Max. torque (Al can stud)	10 Nm
Mounting position	Only in the upright position. See “Maintenance and Installation Manual” for further details.

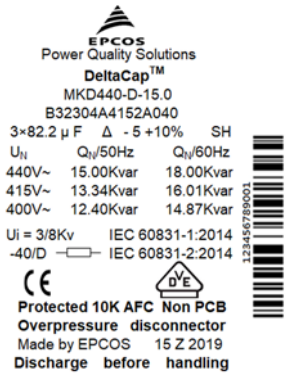
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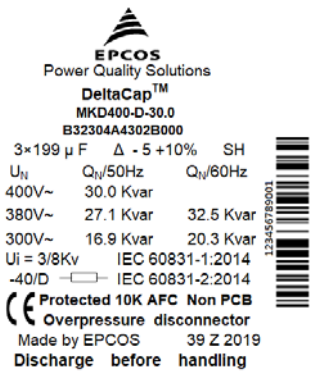
Terminals	
Protection degree	IP00 for B32303; IP20 for B32304
Max. torque	2 Nm
Maximum terminal current	50 A (screw terminals and hose cables) 15 A (fast on terminals)
Creepage distance (min)	12.7 mm (to UL 810)
Clearance (min)	9.6 mm (to UL 810)

Safety	
Mechanical safety	Overpressure disconnector
Max. short circuit current	(AFC: 10 kA according UL 810 standard)
Discharge resistor time	≤ 60 s to 75 V or less

Reference standards
IEC 60831-1:2014, IEC60831-2:2014 VDE approval for most of the types. For detailed information please contact our local sales office.

Label design





Important remark



Hereafter mentioned capacitors with the wildcard character "#" are available either with integrated resistors with 3 terminals (B32304*****A*** series) or with pluggable ceramic base discharge resistor with 6 terminals (B32304*****B*** series).

The main difference between B32304A****A*** series and B32304A****B*** series is the way of assembling the discharge resistor. The resistor of B32304A****A*** series is assembled inside of capacitor terminal cover, the ceramic resistor of B32304A****B*** is plugged into the terminal pin.

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Ordering codes

Type	50 Hz		60 Hz		C_R	d × h	Weight	Ordering code	Packing unit
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		pcs
Rated voltage 230 V AC, 50/60 Hz, delta connection									
MKD230-D-0.5	0.5	1.3	0.6	1.6	3 o 10	50 x 150	0.4	B32303A2002A530	50
MKD230-D-0.7	0.7	1.8	0.8	2.2	3 o 14	50 x 150	0.4	B32303A2002A730	50
MKD230-D-1.0	1.0	2.5	1.2	3.0	3 o 20	50 x 150	0.4	B32303A2012A030	50
MKD230-D-1.5	1.5	3.8	1.8	4.6	3 o 30	63.5 x 150	0.6	B32303A2012A530	12
MKD230-D-2.0	2.0	5.0	2.4	6.0	3 o 40	63.5 x 150	0.6	B32303A2022A030	12
MKD230-D-2.5	2.5	6.3	3.0	7.6	3 o 50	63.5 x 150	0.8	B32303A2022A530	12
MKD230-D-5.0	5.0	12.6	6.0	15.1	3 o 100	75 x 200	1.1	B32304A2052#030*	6
MKD230-D-7.5	7.5	18.8	9.0	22.6	3 o 151	75 x 275	1.4	B32304A2072#530*	6
MKD230-D-10.0	10.0	25.1	12.0	30.1	3 o 201	85 x 275	1.7	B32304A2102#030*	4
MKD230-D-12.5	12.5	31.4	15.0	37.7	3 o 251	85 x 350	2.2	B32304A2122#530*	4
MKD230-D-15.0	15.0	37.7	18.0	45.2	3 o 301	85 x 350	2.2	B32304A2152#030*	4
Rated voltage 400 V AC, 50/60 Hz, delta connection									
MKD400-D-1.0	1.0	1.4	1.2	1.7	3 o 6.6	50 x 150	0.4	B32303A4012A000	50
MKD400-D-1.5	1.5	2.2	1.8	2.6	3 o 10	50 x 150	0.4	B32303A4012A500	50
MKD400-D-2.0	2.0	2.9	2.4	3.5	3 o 13	50 x 150	0.4	B32303A4022A000	50
MKD400-D-2.5	2.5	3.6	3.0	4.3	3 o 17	50 x 150	0.4	B32303A4022A500	50
MKD400-D-5.0	5.0	7.2	6.0	8.6	3 o 33	63.5 x 150	0.6	B32303A4052A000	12
MKD400-D-6.3	6.3	9.1	7.6	10.9	3 o 42	75 x 163	0.8	B32304A4071#500*	6
MKD400-D-7.5	7.5	10.8	9.0	13.0	3 o 50	75 x 163	0.9	B32304A4072#500*	6
MKD400-D-8.3	8.3	12.0	10.0	14.4	3 o 55	75 x 200	1.1	B32304A4101#000*	6
MKD400-D-10.0	10.0	14.4	12.0	17.3	3 o 66	75 x 200	1.1	B32304A4102#000*	6
MKD400-D-12.5	12.5	18.0	15.0	21.6	3 o 83	75 x 275	1.4	B32304A4122#500*	6
MKD400-D-15.0	15.0	21.7	18.0	26.0	3 o 100	75 x 275	1.4	B32304A4152#000*	6
MKD400-D-16.7	16.7	24.1	20.0	28.9	3 o 111	85 x 275	1.8	B32304A4201#000*	4
MKD400-D-20.0	20.0	28.9	24.0	34.7	3 o 133	85 x 275	1.8	B32304A4202#000*	4
MKD400-D-25.0	25.0	36.1	30.0	43.3	3 o 166	85 x 350	2.2	B32304A4252#000*	4
MKD400-D-30.0	30.0	43.3	--	--	3 o 199	96 x 275	2.4	B32304A4302#000*	4

* Available either as B32304A****A*** series (3-terminal design, integrated resistor) or B32304A****B*** series (6-terminal design, pluggable ceramic resistor). Please replace # with the right character before ordering.

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Type	50 Hz		60 Hz		C_R	d × h	Weight	Ordering code	Packing unit
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		pcs
Rated voltage 415 V AC, 50/60 Hz, delta connection									
MKD415-D-1.0	1.0	1.4	1.2	1.7	3 o 6.2	50 x 150	0.4	B32303A4012A010	50
MKD415-D-1.5	1.5	2.1	1.8	2.5	3 o 9.2	50 x 150	0.4	B32303A4012A510	50
MKD415-D-2.0	2.0	2.8	2.4	3.4	3 o 12	50 x 150	0.4	B32303A4022A010	50
MKD415-D-2.5	2.5	3.5	3.0	4.2	3 o 15	63.5 x 150	0.6	B32303A4022A510	12
MKD415-D-5.0	5.0	7.0	6.0	8.4	3 o 31	63.5 x 150	0.8	B32303A4052A010	12
MKD415-D-6.3	6.3	8.8	7.6	10.6	3 o 39	75 x 200	1.0	B32304A4071#510*	6
MKD415-D-7.5	7.5	10.4	9.0	12.5	3 o 46	75 x 200	1.1	B32304A4072#510*	6
MKD415-D-10.0	10.0	13.9	12.0	16.7	3 o 62	75 x 275	1.4	B32304A4102#010*	6
MKD415-D-12.5	12.5	17.4	15.0	20.9	3 o 77	75 x 275	1.4	B32304A4122#510*	6
MKD415-D-15.0	15.0	20.9	18.0	25.1	3 o 93	85 x 275	1.7	B32304A4152#010*	4
MKD415-D-20.0	20.0	27.8	24.0	33.4	3 o 123	85 x 275	2.2	B32304A4202#010*	4
MKD415-D-20.8	20.8	28.9	25.0	34.7	3 o 128	85 x 350	2.4	B32304A4251#010*	4
MKD415-D-25.0	25.0	34.8	30.0	41.8	3 o 154	85 x 350	2.4	B32304A4252#010*	4
MKD415-D-30.0	30.0	41.7	36.0	50.0	3 o 185	96 x 350	2.7	B32304A4302#010*	4
Rated voltage 440 V AC, 50/60 Hz, delta connection									
MKD440-D-0.9	0.9	1.2	1.1	1.4	3 o 5.2	50 x 127	0.4	B32303A4011A040	50
MKD440-D-1.0	1.0	1.3	1.2	1.6	3 o 5.5	50 x 127	0.4	B32303A4012A040	50
MKD440-D-1.2	1.2	1.6	1.4	1.9	3 o 6.6	50 x 127	0.4	B32303A4011A540	50
MKD440-D-1.5	1.5	2.0	1.8	2.4	3 o 8.8	50 x 127	0.4	B32303A4012A540	50
MKD440-D-2.0	2.0	2.6	2.4	3.1	3 o 11	50 x 150	0.5	B32303A4022A040	50
MKD440-D-2.1	2.1	2.8	2.5	3.4	3 o 12	50 x 150	0.5	B32303A4021A540	50
MKD440-D-2.5	2.5	3.3	3.0	4.0	3 o 14	63.5 x 150	0.7	B32303A4022A540	12
MKD440-D-4.2	4.2	5.5	5.0	6.6	3 o 23	63.5 x 150	0.7	B32303A4051A040	12
MKD440-D-5.0	5.0	6.6	6.0	7.9	3 o 27	63.5 x 150	0.8	B32303A4052A040	12
MKD440-D-6.3	6.3	8.3	7.6	10.0	3 o 35	75 x 163	0.8	B32304A4071#540*	6
MKD440-D-7.5	7.5	9.8	9.0	11.8	3 o 41	75 x 200	1.1	B32304A4072#540*	6
MKD440-D-8.3	8.3	10.9	10.0	13.1	3 o 46	75 x 200	1.1	B32304A4101#040*	6
MKD440-D-10.0	10.0	13.1	12.0	15.7	3 o 55	75 x 275	1.4	B32304A4102#040*	6
MKD440-D-10.4	10.4	13.6	12.5	16.3	3 o 57	75 x 275	1.4	B32304A4121#540*	6
MKD440-D-12.5	12.5	16.4	15.0	19.7	3 o 69	75 x 275	1.4	B32304A4151#040*	6
MKD440-D-15.0	15.0	19.7	18.0	23.6	3 o 82	85 x 275	1.7	B32304A4152#040*	4
MKD440-D-16.7	16.7	21.9	20.0	26.3	3 o 92	85 x 275	1.7	B32304A4201#040*	4
MKD440-D-20.0	20.0	26.2	24.0	31.5	3 o 110	85 x 275	1.9	B32304A4202#040*	4
MKD440-D-20.8	20.8	27.3	25.0	32.8	3 o 114	85 x 350	2.2	B32304A4251#040*	4
MKD440-D-25.0	25.0	32.8	30.0	39.4	3 o 137	85 x 350	2.2	B32304A4252#040*	4

* Available either as B32304A****A*** series (3-terminal design, integrated resistor) or B32304A****B*** series (6-terminal design, pluggable ceramic resistor). Please replace # with the right character before ordering.

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Type	50 Hz		60 Hz		C_R	d × h	Weight	Ordering code	Packing unit
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		pcs
Rated voltage 440 V AC, 50/60 Hz, delta connection - continue									
MKD440-D-28.0	28.0	36.7	33.6	44.0	3 o 154	85 x 350	2.2	B32304A4282#040*	4
MKD440-D-30.0	30.0	39.0	--	--	3 o 164	96 x 350	2.7	B32304A4302#040*	4
MKD440-D-33.0	33.0	43.3	--	--	3 o 181	96 x 350	2.7	B32304A4332#040*	4
MKD440-D-33.8	33.8	44.4	--	--	3 o 185	96 x 350	2.7	B32304A4332#840*	4

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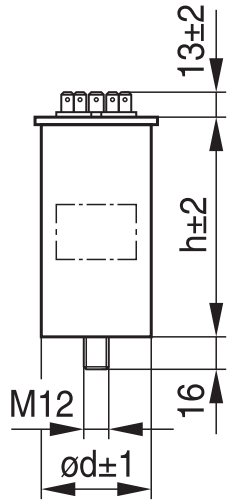
Type	50 Hz		60 Hz		C_R	d × h	Weight	Ordering code	Packing unit
	Output kvar	I_R A	Output kvar	I_R A	µF	mm	kg		pcs
Rated voltage 480 V AC, 50/60 Hz, delta connection									
MKD480-D-1.5	1.5	1.8	1.8	2.2	3 o 6.9	50 x 127	0.4	B32303A4012A580	50
MKD480-D-2.0	2.0	2.4	2.4	2.9	3 o 9.2	50 x 150	0.5	B32303A4022A080	50
MKD480-D-2.5	2.5	3.0	3.0	3.6	3 o 12	63.5 x 150	0.7	B32303A4022A580	12
MKD480-D-5.0	5.0	6.0	6.0	7.2	3 o 23	75 x 163	0.8	B32304A4052#080*	6
MKD480-D-6.3	6.3	7.6	7.6	9.1	3 o 29	75 x 163	0.8	B32304A4071#580*	6
MKD480-D-7.5	7.5	9.0	9.0	10.8	3 o 35	75 x 200	1.1	B32304A4072#580*	6
MKD480-D-8.3	8.3	10.0	10.0	12.0	3 o 38	75 x 200	1.1	B32304A4101#080*	6
MKD480-D-10.4	10.4	12.5	12.5	15.0	3 o 48	75 x 275	1.4	B32304A4121#580*	6
MKD480-D-12.5	12.5	15.0	15.0	18.0	3 o 58	75 x 275	1.4	B32304A4151#080*	6
MKD480-D-15.0	15.0	18.0	18.0	21.6	3 o 69	85 x 275	1.7	B32304A4152#080*	4
MKD480-D-16.7	16.7	20.1	20.0	24.1	3 o 77	85 x 275	1.8	B32304A4162#780*	4
MKD480-D-20.0	20.0	24.1	24.0	28.9	3 o 92	85 x 350	2.2	B32304A4201#080*	4
MKD480-D-20.8	20.8	25.0	25.0	30.0	3 o 96	85 x 350	2.2	B32304A4202#080*	4
MKD480-D-25.0	25.0	30.1	30.0	36.1	3 o 115	85 x 350	2.2	B32304A4252#080*	4
MKD480-D-30.0	30.0	36.0	36.0	43.0	3 o 138	96 x 350	2.7	B32304A4302#080*	4
MKD480-D-33.0	33	39.7	--	--	3 • 152	96 x 350	2.7	B32304A4332#080*	4
Rated voltage 525 V AC, 50/60 Hz, delta connection									
MKD525-D-1.0	1.0	1.1	1.2	1.3	3 o 3.9	50 x 150	0.4	B32303A5012A020	50
MKD525-D-1.5	1.5	1.6	1.8	1.9	3 o 5.8	50 x 150	0.4	B32303A5012A520	50
MKD525-D-2.0	2.0	2.2	2.4	2.6	3 o 7.7	63.5 x 150	0.6	B32303A5022A020	12
MKD525-D-2.5	2.5	2.7	3.0	3.2	3 o 9.6	63.5 x 150	0.6	B32303A5022A520	12
MKD525-D-5.0	5.0	5.5	6.0	6.6	3 o 19	75 x 163	0.8	B32304A5061#020*	6
MKD525-D-6.3	6.3	6.9	7.6	8.3	3 o 24	75 x 200	1.0	B32304A5071#520*	6
MKD525-D-8.3	8.3	9.1	10.0	10.9	3 o 32	75 x 275	1.4	B32304A5101#020*	6
MKD525-D-10.4	10.4	11.4	12.5	13.7	3 o 40	75 x 275	1.4	B32304A5121#520*	6
MKD525-D-12.5	12.5	13.7	15.0	16.4	3 o 48	75 x 275	1.4	B32304A5151#020*	6
MKD525-D-16.7	16.7	18.4	20.0	22.1	3 o 64	85 x 275	1.8	B32304A5201#020*	4
MKD525-D-20.8	20.8	22.9	25.0	27.5	3 o 80	85 x 350	2.2	B32304A5202#020*	4
MKD525-D-25.0	25.0	27.5	30.0	33.0	3 o 96	85 x 350	2.2	B32304A5252#020*	4
MKD525-D-30.0	30.0	33.0	36.0	39.0	3 o 115	96 x 350	2.7	B32304A5302#020*	4

* Available either as B32304A****A*** series (3-terminal design, integrated resistor) or B32304A****B*** series (6-terminal design, pluggable ceramic resistor). Please replace # with the right character before ordering.

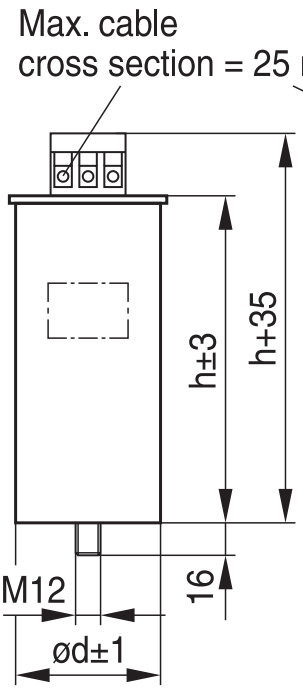
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Dimensional drawings

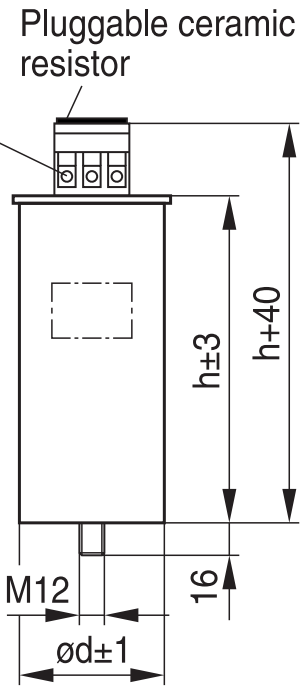
B32303 series



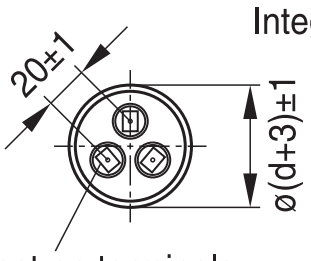
B32304*****A*** series

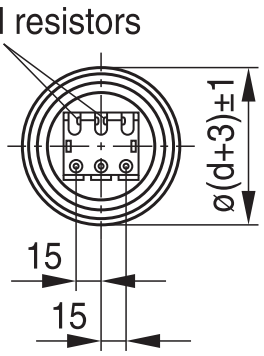


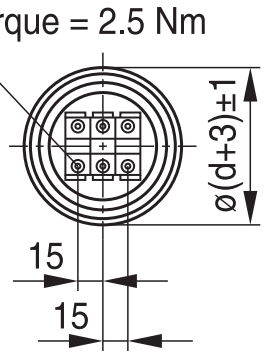
B32304*****B*** series



Torque = 10 Nm, Toothed washer J12 DIN 6797, Hex nut BM 12 DIN 439







Creepage distance > 12.7 mm
Distance in air > 10 mm

KLK1857-M-E

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Cautions and warnings

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

Mechanical protection

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

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

- Check tightness of the connections/terminals periodically.
- Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- In case of current above the nominal current check your application for modifications.
- If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- Check the discharge resistors/reactors and in case of doubt, check their function:
  (1) Power the capacitor up and down.
  (2) After ≤ 60 seconds the voltage between the terminals must decline to less than 75 V.
- Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should 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.

Note

For detailed information about PFC capacitors and cautions, refer to the latest version of PFC Product Profile.

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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

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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..

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Important notes

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.

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