WIMA MKS 4

Metallized Polyester (PET) Capacitors
PCM 7.5 mm to 37.5 mm

Special Features

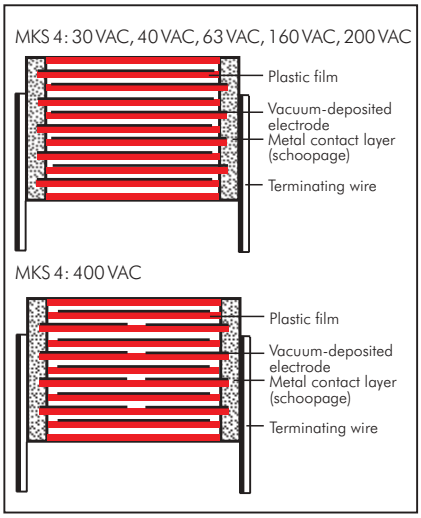
- **High volume/capacitance ratio**
- **Self-healing**
- **According to RoHS 2002/95/EC**

Typical Applications

For general DC-applications e.g.
- **By-pass**
- **Blocking**
- **Coupling and decoupling**
- **Timing**

Construction

Dielectric:
Polyethylene-terephthalate (PET) film
Capacitor electrodes:
Vacuum-deposited
Internal construction:



Encapsulation:
Solvent-resistant, flame-retardent plastic case with epoxy resin seal, UL 94 V-0
Terminations:
Tinned wire.
Marking:
Colour: Red. Marking: Black.
Epoxy resin seal: Red

Electrical Data

Capacitance range:
1000 pF to 220 µF (E12-values on request)
Rated voltages:
50 VDC, 63 VDC, 100 VDC, 250 VDC, 400 VDC, 630 VDC, 1000 VDC, 1500 VDC, 2000 VDC
Capacitance tolerances:
±20%, ±10% ±5%
Operating temperature range:
–55° C to +100° C
Climatic test category:
55/100/56 in accordance with IEC
Insulation resistance at +20° C:

Test voltage: 1.6 U_r, 2 sec.
Test specifications:
In accordance with IEC 60384-2 and EN 130400
Voltage derating:
A voltage derating factor of 1.25 % per K must be applied from +85° C for DC voltages and from +75° C for AC voltages.
Reliability:
Operational life > 300000 hours
Failure rate < 2 fit (0.5 x U_r and 40° C)

U_r	U_{test}	C ⩽ 0.33 µF	0.33 µF < C ⩽ 220 µF
50 VDC	100 V	⩾5 x 10^3 MΩ (mean value: 3 x 10^4 MΩ)	⩾1500 sec (MΩ x µF) (mean value: 4500 sec)
63 VDC	100 V	⩾1 x 10^4 MΩ (mean value: 5 x 10^4 MΩ)	⩾3000 sec (MΩ x µF) (mean value: 6000 sec)
100 VDC	100 V	⩾1.5 x 10^4 MΩ (mean value: 5 x 10^4 MΩ)	⩾5000 sec (MΩ x µF) (mean value: 15000 sec)
⩾250 VDC	100 V	⩾3 x 10^4 MΩ (mean value: 1 x 10^5 MΩ)	⩾10000 sec (MΩ x µF) (mean value: 40000 sec)

Measuring time: 1 min.
Dissipation factors at + 20° C: tan δ

at f	C ⩽ 0.1 µF	0.1 µF < C ⩽ 1.0 µF	C > 1.0 µF
1 kHz	⩽ 8 x 10^{-3}	⩽ 8 x 10^{-3}	⩽ 10 x 10^{-3}
10 kHz	⩽ 15 x 10^{-3}	⩽ 15 x 10^{-3}	–
100 kHz	⩽ 30 x 10^{-3}	–	–

Maximum pulse rise time:

Capacitance pF/µF	Pulse rise time V/µsec max. operation/test								
	50VDC	63VDC	100VDC	250VDC	400VDC	630VDC	1000VDC	1500VDC	2000VDC
1000 ... 6800	–	–	–	–	–	–	70/700	90/900	100/1000
0.01 ... 0.022	–	30/300	30/300	35/350	38/380	40/400	50/500	50/500	60/600
0.033 ... 0.068	–	15/150	15/150	20/200	25/250	32/320	26/260	35/350	40/400
0.1 ... 0.22	10/100	10/100	12/120	15/150	15/150	17/170	20/200	35/350	40/400
0.33 ... 0.68	9/90	9/90	9/90	10/100	10/100	13/130	20/200	20/200	38/380
1.0 ... 2.2	6/60	6/60	5/50	6/60	9/90	13/130	14/140	15/150	–
3.3 ... 6.8	2.5/25	3/30	3/30	6/60	6/60	9/90	12/120	–	–
10 ... 220	2.5/25	2.5/25	2.5/25	3/30	6/60	–	–	–	–

for pulses equal to the rated voltage

Mechanical Tests

Pull test on leads:
d ⩽ 0.8 ø: 10 N in direction of leads
d > 0.8 ø: 20 N in direction of leads
according to IEC 60068-2-21
Vibration:
6 hours at 10 ... 2000 Hz and 0.75 mm displacement amplitude or 10 g in accordance with IEC 60068-2-6
Low air density:
1kPa = 10 mbar in accordance with IEC 60068-2-13
Bump test: 4000 bumps at 390 m/sec^2 in accordance with IEC 60068-2-29

Packing

Available taped and reeled up to and including case size 15 x 26 x 31.5 / PCM 27.5 mm.

Detailed taping information and graphs at the end of the catalogue.

For further details and graphs please refer to Technical Information.

Continuation

General Data

Capac-itance	50 VDC/30 VAC*				63 VDC/40 VAC*				100 VDC/63 VAC*				250 VDC/160 VAC*				400 VDC/200 VAC*			
	W	H	L	PCM**	W	H	L	PCM**	W	H	L	PCM**	W	H	L	PCM**	W	H	L	PCM**
0.01 µF					2.5	7	10	**7.5***	2.5	7	10	**7.5***	3	8.5	10	**7.5***	3	8.5	10	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	4	9	13	10*
0.015 "					2.5	7	10	**7.5***	2.5	7	10	**7.5***	3	8.5	10	**7.5***	3	8.5	10	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	4	9	13	10*
0.022 "					2.5	7	10	**7.5***	2.5	7	10	**7.5***	3	8.5	10	**7.5***	4	9	10	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	4	9	13	10*
0.033 "					2.5	7	10	**7.5***	2.5	7	10	**7.5***	3	8.5	10	**7.5***	4	9	10	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	4	9	13	10*
0.047 "					2.5	7	10	**7.5***	2.5	7	10	**7.5***	3	8.5	10	**7.5***	5	10.5	10.3	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	4	9	13	10*
0.068 "					2.5	7	10	**7.5***	2.5	7	10	**7.5***	4	9	10	**7.5***	5	10.5	10.3	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	4	9	13	10*
0.1 µF	2.5	7	10	**7.5**	2.5	7	10	**7.5***	2.5	7	10	**7.5***	4	9	10	**7.5***	5	10.5	10.3	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	5	11	13	10*
0.15 "	2.5	7	10	**7.5**	2.5	7	10	**7.5***	3	8.5	10	**7.5***	5	10.5	10.3	**7.5***	5.7	12.5	10.3	**7.5***
					4	9	13	10*	4	9	13	10*	4	9	13	10*	6	12	13	10*
0.22 "	2.5	7	10	**7.5**	3	8.5	10	**7.5***	3	8.5	10	**7.5***	5	10.5	10.3	**7.5***	6	12	13	10*
					4	9	13	10*	4	9	13	10*	5	11	13	10*	6	12.5	18	15*
0.33 "	2.5	7	10	**7.5**	4	9	10	**7.5***	4	9	10	**7.5***	5.7	12.5	10.3	**7.5***	8	15	18	15
					4	9	13	10*	4	9	13	10*	5	11	13	10*				
0.47 "	3	8.5	10	**7.5**	4	9	10	**7.5***	4.5	9.5	10.3	**7.5***	6	12	13	10*	8	15	18	15*
					4	9	13	10*	4	9	13	10*	6	12.5	18	15*	6	15	26.5	22.5*
0.68 "	4	9	10	**7.5**	5	10.5	10.3	**7.5***	5	10.5	10.3	**7.5***	7	14	18	15	7	16.5	26.5	22.5
					4	9	13	10*	4	9	13	10*								
1.0 µF	4	9	10	**7.5**	5	10.5	10.3	**7.5***	5.7	12.5	10.3	**7.5***	8	15	18	15*	10.5	19	26.5	22.5*
					4	9	13	10*	5	11	13	10*	6	15	26.5	22.5*	11	21	31.5	27.5*
1.5 "	5	10.5	10.3	**7.5**	5.7	12.5	10.3	**7.5***	6	12	13	10*	9	16	18	15*	11	21	26.5	22.5*
					5	11	13	10*	7	14	18	15*	7	16.5	26.5	22.5*	11	21	31.5	27.5*
2.2 "	5.7	12.5	10.3	**7.5**	5	11	13	10*	8	15	18	15*	10.5	19	26.5	22.5*	11	21	31.5	27.5
					6	12.5	18	15*	6	15	26.5	22.5*	9	19	31.5	27.5*				
3.3 "	5.7	12.5	10.3	**7.5**	6	12	13	10*	9	16	18	15*	11	21	26.5	22.5*	13	24	31.5	27.5
					7	14	18	15*	7	16.5	26.5	22.5*	11	21	31.5	27.5*				
4.7 "	7.2	12.5	10.3	**7.5***	7	14	18	15*	10.5	19	26.5	22.5*	11	21	31.5	27.5	17	29	31.5	27.5
	6	12	13	10*	6	15	26.5	22.5*	9	19	31.5	27.5*								
6.8 "	7.2	12.5	10.3	**7.5***	8	15	18	15*	10.5	19	26.5	22.5*	13	24	31.5	27.5	17	34.5	31.5	27.5*
	6	12	13	10*	7	16.5	26.5	22.5*	11	21	31.5	27.5*					15	26	41.5	37.5*
10 µF	9	16	18	15	8.5	18.5	26.5	22.5*	13	24	31.5	27.5	17	29	31.5	27.5	19	32	41.5	37.5
					11	21	31.5	27.5*												
15 "	11	21	26.5	22.5	11	21	26.5	22.5*	13	24	31.5	27.5	17	34.5	31.5	27.5*	20	39.5	41.5	37.5
					11	21	31.5	27.5*					17	29	41.5	37.5*				
22 "	11	21	31.5	27.5	13	24	31.5	27.5	15	26	31.5	27.5	19	32	41.5	37.5				
33 "	13	24	31.5	27.5	15	26	31.5	27.5	17	29	31.5	27.5*	24	45.5	41.5	37.5				
									13	24	41.5	37.5*								
47 "	15	26	31.5	27.5*	17	29	31.5	27.5*	17	29	41.5	37.5								
	13	24	41.5	37.5*	17	29	41.5	37.5*												
68 "	20	39.5	31.5	27.5*	20	39.5	31.5	27.5*	20	39.5	41.5	37.5								
	17	29	41.5	37.5*	19	32	41.5	37.5*												
100 µF	19	32	41.5	37.5	20	39.5	41.5	37.5	24	45.5	41.5	37.5								
150 "	20	39.5	41.5	37.5	24	45.5	41.5	37.5												
220 "	24	45.5	41.5	37.5																

* AC voltage: f = 50 Hz; 1.4 x U_{rms} + UDC ⩽ U_r

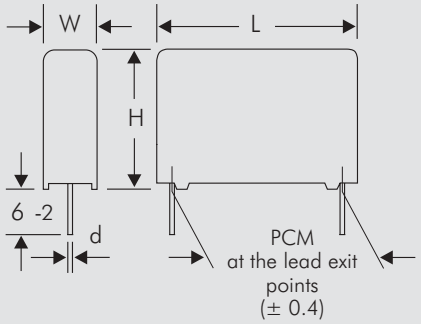
** PCM = Printed circuit module = lead spacing

* On ordering please state the required PCM (lead spacing)!
If not specified, smaller PCM will be booked.

Dims. in mm.

Taped version see page 104.

ø d	PCM	W
0.5	7.5	⩽ 3
0.6	7.5	⩾ 4
0.6	10	
0.8	15 - 27.5	
1.0	37.5	



Continuation page 59

Continuation

General Data

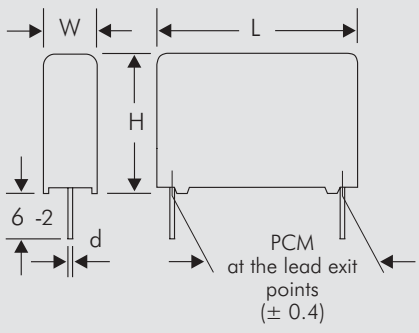
Capacitance	630 VDC/400 VAC*				1000 VDC/400 VAC*				1500 VDC/400 VAC*				2000 VDC/400 VAC*			
	W	H	L	PCM**	W	H	L	PCM**	W	H	L	PCM**	W	H	L	PCM**
1000 pF					3	8.5	10	**7.5***	4	9	13	10	4	9	13	10
					4	9	13	10*								
1500 "					3	8.5	10	**7.5***	4	9	13	10	4	9	13	10
					4	9	13	10*								
2200 "					3	8.5	10	**7.5***	4	9	13	10	5	11	13	10
					4	9	13	10*								
3300 "					4	9	10	**7.5***	4	9	13	10	6	12	13	10*
					4	9	13	10*					5	11	18	15*
4700 "					4	9	10	**7.5***	4	9	13	10*	5	11	18	15
					4	9	13	10*	5	11	18	15*				
6800 "					4.5	9.5	10.3	**7.5***	5	11	13	10*	6	12.5	18	15
					4	9	13	10*	5	11	18	15*				
0.01 µF	3	8.5	10	**7.5****	5	10.5	10.3	**7.5***	6	12	13	10*	7	14	18	15*
	4	9	13	10*	5	11	13	10*	5	11	18	15*	6	15	26.5	22.5*
0.015 "	4	9	10	**7.5****	5.7	12.5	10.3	**7.5***	6	12.5	18	15	6	15	26.5	22.5
	4	9	13	10*	6	12	13	10*								
0.022 "	4.5	9.5	10.3	**7.5****	5	11	18	15	7	14	18	15*	7	16.5	26.5	22.5
	4	9	13	10*					6	15	26.5	22.5*				
0.033 "	5	10.5	10.3	**7.5****	6	12.5	18	15*	8	15	18	15*	10.5	19	26.5	22.5
	5	11	13	10*	6	15	26.5	22.5*	6	15	26.5	22.5*				
0.047 "	5.7	12.5	10.3	**7.5****	7	14	18	15*	7	16.5	26.5	22.5	11	21	26.5	22.5*
	6	12	13	10*	6	15	26.5	22.5*					11	21	31.5	27.5*
0.068 "	6	12	13	10*	8	15	18	15*	8.5	18.5	26.5	22.5	11	21	31.5	27.5
	5	11	18	15*	6	15	26.5	22.5*								
0.1 µF	6	12.5	18	15*	9	16	18	15*	10.5	19	26.5	22.5*	13	24	31.5	27.5
	6	15	26.5	22.5*	7	16.5	26.5	22.5*	9	19	31.5	27.5*				
0.15 "	7	14	18	15*	8.5	18.5	26.5	22.5	11	21	31.5	27.5	17	29	31.5	27.5*
	6	15	26.5	22.5*									13	24	41.5	37.5*
0.22 "	8	15	18	15*	10.5	19	26.5	22.5	13	24	31.5	27.5	17	29	41.5	37.5
	6	15	26.5	22.5*												
0.33 "	7	16.5	26.5	22.5*	11	21	26.5	22.5*	17	34.5	31.5	27.5*	20	39.5	41.5	37.5
	9	19	31.5	27.5*	11	21	31.5	27.5*	17	29	41.5	37.5*				
0.47 "	10.5	19	26.5	22.5*	13	24	31.5	27.5	20	39.5	31.5	27.5*	24	45.5	41.5	37.5
	9	19	31.5	27.5*					17	29	41.5	37.5*				
0.68 "	11	21	26.5	22.5*	15	26	31.5	27.5	20	39.5	41.5	37.5				
	11	21	31.5	27.5*												
1.0 µF	11	21	31.5	27.5	17	29	31.5	27.5*	24	45.5	41.5	37.5				
					17	29	41.5	37.5*								
1.5 "	15	26	31.5	27.5	19	32	41.5	37.5								
2.2 "	17	34.5	31.5	27.5*	20	39.5	41.5	37.5								
	15	26	41.5	37.5*												
3.3 "	20	39.5	31.5	27.5*	24	45.5	41.5	37.5								
	19	32	41.5	37.5*												
4.7 "	20	39.5	41.5	37.5												
6.8 "	24	45.5	41.5	37.5												

* AC voltage: f = 50 Hz; 1.4 x U_{rms} + UDC ⩽ U_r

** PCM = Printed circuit module = lead spacing

* On ordering please state the required PCM (lead spacing)!
If not specified, smaller PCM will be booked.

ø d	PCM	W
0.5	7.5	⩽ 3
0.6	7.5	⩾ 4
0.6	10	
0.8	15 - 27.5	
1.0	37.5	



** Admissible AC voltage 250 VAC max.

Dims. in mm.

Taped version see page 104.

AC voltage graphs see page 66

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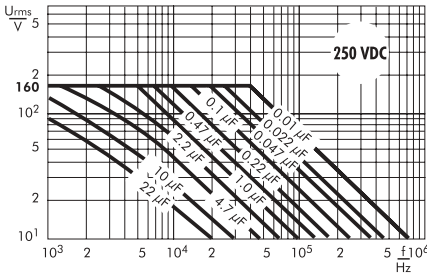
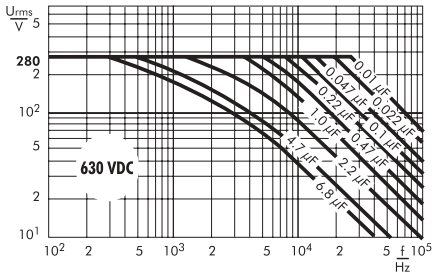
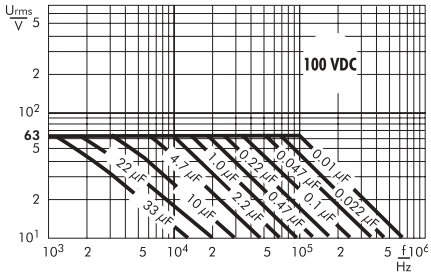
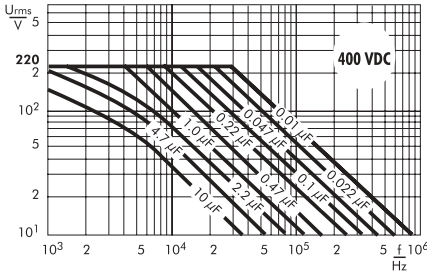
Continuation

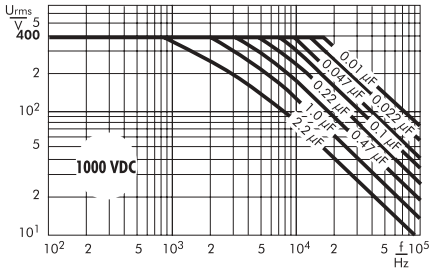
Permissible AC voltage
in relation to frequency
at 10° C internal temperature rise
(general guide).











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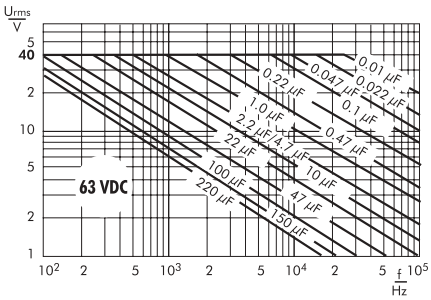
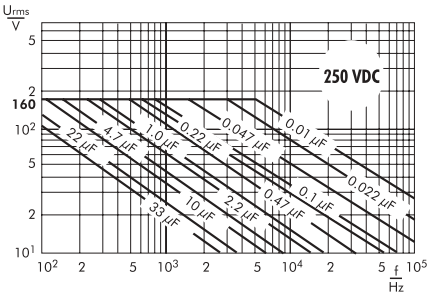
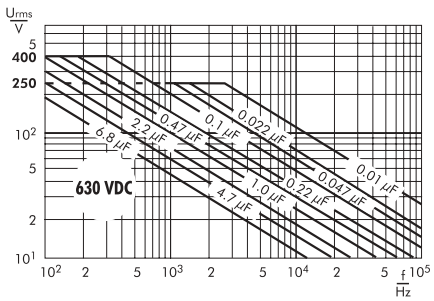
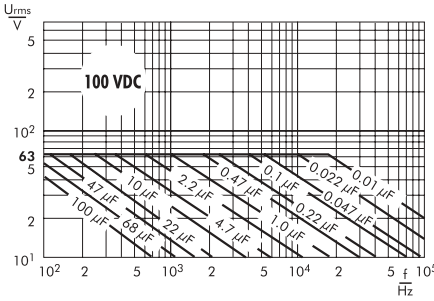
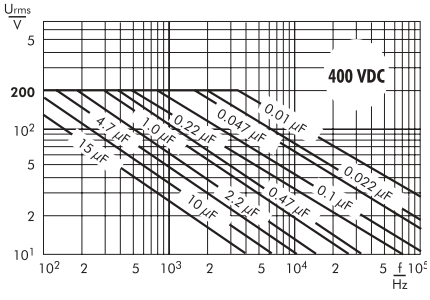
Permissible AC voltage in relation to frequency at 10° C internal temperature rise (general guide).

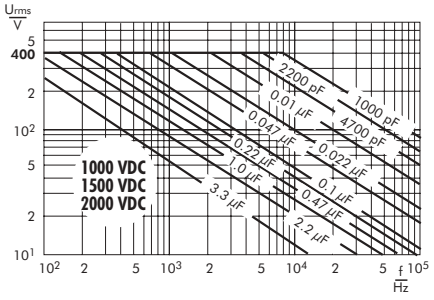












Technical information and general data see page 57.

Recommendation for Processing and Application of Through-Hole Capacitors

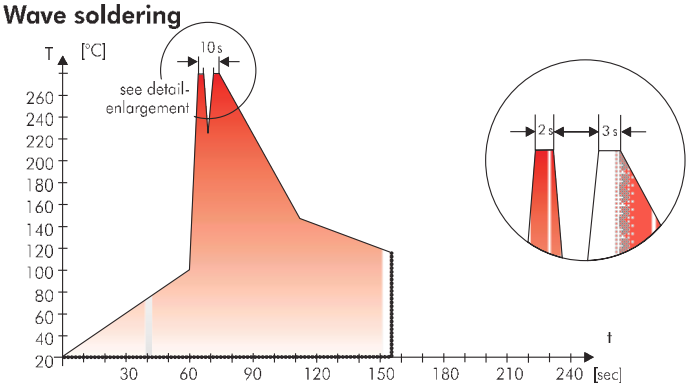
Soldering Process

A preheating of through-hole WIMA capacitors is allowed for temperatures T_{max} (100 °C.
In practice a preheating duration of t (5 min. has been proven to be best.

Single wave soldering
Soldering bath temperature: T (260 °C
Immersion time: t (5 sec

Double wave soldering
Soldering bath temperature: T (260 °C
Immersion time: 2 x t (3 sec

Wave soldering



Temperature/time graph for the maximum permissible solder bath temperature for the wave soldering of through-hole WIMA capacitors

WIMA Quality and Environmental Philosophy

ISO 9001:2000 Certification

ISO 9001:2000 is an international basic standard of quality assurance systems for all branches of industry. The approval according to ISO 9001:2000 of our factories by the VDE inspectorate certifies that organisation, equipment and monitoring of quality assurance in our factories correspond to internationally recognized standards.

WIMA WPCS

The WIMA Process Control System (WPCS) is a quality surveillance and optimization system developed by WIMA. WPCS is a major part of the quality-oriented WIMA production. Points of application of WPCS during production process:

- **incoming material inspection**
- **metallization**
- **film inspection**
- **schoopage**
- **pre-healing**
- **lead attachment**
- **cast resin preparation/ encapsulation**
- **100% final inspection**
- **AQL check**

WIMA Environmental Policy

All WIMA capacitors, irrespective of whether through-hole devices or SMD, are made of environmentally friendly materials. Neither during manufacture nor in the product itself any toxic substances are used, e.g.

- **Lead**
- **PCB**
- **CFC**
- **Hydrocarbon chloride**
- **Chromium 6+**
- **PBB/PBDE**
- **Arsenic**
- **Cadmium**
- **Mercury**
- **etc.**

We merely use pure, recyclable materials for packing our components, such as:

- **carton**
- **cardboard**
- **adhesive tape made of paper**
- **polystyrene**

We almost completely refrain from using packing materials such as:

- **foamed polystyrene (Styropor®)**
- **adhesive tapes made of plastic**
- **metal clips**

RoHS Compliance

According to the RoHS Directive 2002/95/EC certain hazardous substances like e.g. lead, cadmium, mercury must not be used any longer in electronic equipment as of July 1st, 2006. For the sake of the environment WIMA has refraind from using such substances since years already.

Tape for lead-free WIMA capacitors

DIN EN ISO 14001:2005

WIMA's environmental management has been established in accordance with the guidelines of DIN EN ISO 14001:2005. The certification has been granted in June 2006.

09.06

Typical Dimensions for Taping Configuration

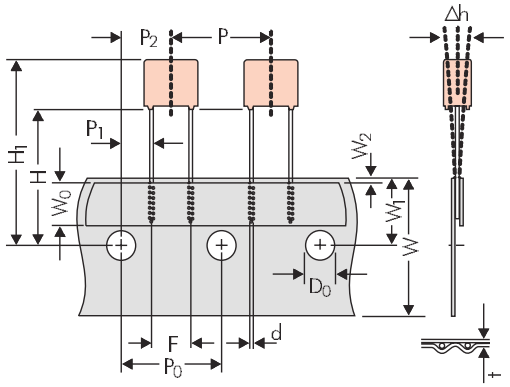


Diagram 1:
PCM 2.5/5/7.5mm

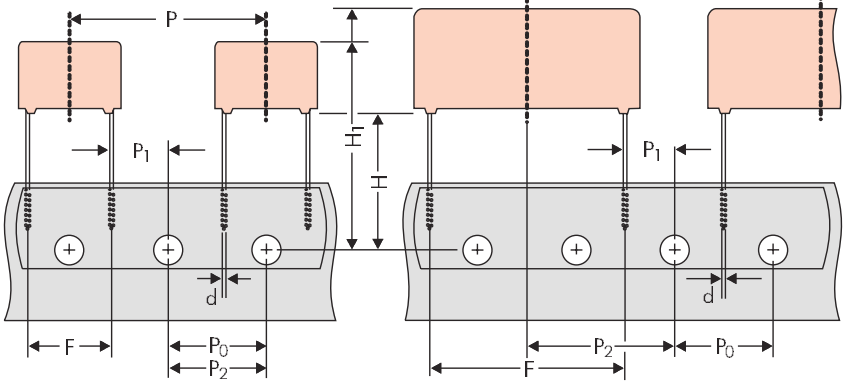


Diagram 2: PCM 10/15 mm

Diagram 3: PCM 22.5 and 27.5*mm
*PCM 27.5 taping possible with two feed holes between components

Designation	Symbol	Dimensions for Radial Taping						
		PCM 2.5 taping	**PCM 5 taping**	**PCM 7.5 taping**	**PCM 10 taping***	**PCM 15 taping***	**PCM 22.5 taping**	**PCM 27.5 taping**
Carrier tape width	W	18.0 ±0.5	18.0 ±0.5	18.0 ±0.5	18.0 ±0.5	18.0 ±0.5	18.0 ±0.5	18.0 ±0.5
Hold-down tape width	W_0	6.0 for hot-sealing adhesive tape	6.0 for hot-sealing adhesive tape	12.0 for hot-sealing adhesive tape	12.0 for hot-sealing adhesive tape	12.0 for hot-sealing adhesive tape	12.0 for hot-sealing adhesive tape	12.0 for hot-sealing adhesive tape
Hole position	W_1	9.0 ±0.5	9.0 ±0.5	9.0 ±0.5	9.0 ±0.5	9.0 ±0.5	9.0 ±0.5	9.0 ±0.5
Hold-down tape position	W_2	0.5 to 3.0 max.	0.5 to 3.0 max.	0.5 to 3.0 max.	0.5 to 3.0 max.	0.5 to 3.0 max.	0.5 to 3.0 max.	0.5 to 3.0 max.
Feed hole diameter	D_0	4.0 ±0.2	4.0 ±0.2	4.0 ±0.2	4.0 ±0.2	4.0 ±0.2	4.0 ±0.2	4.0 ±0.2
Pitch of component	P	12.7 ±1.0	12.7 ±1.0	12.7 ±1.0	25.4 ±1.0	25.4 ±1.0	38.1 ±1.5	*38.1 ±1.5 or 50.8 ±1.5
Feed hole pitch	P_0	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch	12.7 ±0.3 cumulative pitch error max. 1.0 mm/20 pitch
Feed hole centre to lead	P_1	5.1 ±0.5	3.85 ±0.7	2.6 ±0.7	7.7 ±0.7	5.2 ±0.7	7.8 ±0.7	5.3 ±0.7
Hole centre to component centre	P_2	6.35 ±1.3	6.35 ±1.3	6.35 ±1.3	12.7 ±1.3	12.7 ±1.3	19.05 ±1.3	19.05 ±1.3
Feed hole centre to bottom edge of the component	H▲	16.5 ±0.3 18.5 ±0.5	16.5 ±0.3 18.5 ±0.5	16.5 ±0.5 18.5 ±0.5	16.5 ±0.5 18.5 ±0.5	16.5 ±0.5 18.5 ±0.5	16.5 ±0.5 18.5 ±0.5	16.5 ±0.5 18.5 ±0.5
Feed hole centre to top edge of the component	H_1	$H+H_{component} < H_1$ 32.25 max.	$H+H_{component} < H_1$ 32.25 max.	$H+H_{component} < H_1$ 24.5 to 31.5	$H+H_{component} < H_1$ 25.0 to 31.5	$H+H_{component} < H_1$ 26.0 to 37.0	$H+H_{component} < H_1$ 30.0 to 43.0	$H+H_{component} < H_1$ 35.0 to 45.0
Lead spacing at upper edge of carrier tape	F	2.5 ±0.5	5.0 +0.8 −0.2	7.5 ±0.8	10.0 ±0.8	15 ±0.8	22.5 ±0.8	27.5 ±0.8
Lead diameter	d	0.4 ±0.05	0.5 ±0.05	▪0.5 ±0.05 or 0.6 +0.06 −0.05	▪0.5 ±0.05 or 0.6 +0.06 −0.05	0.8 +0.08 −0.05	0.8 +0.08 −0.05	0.8 +0.08 −0.05
Component alignment	Δh	± 2.0 max.	± 2.0 max.	± 3.0 max.	± 3.0 max.	± 3.0 max.	± 3.0 max.	± 3.0 max.
Total tape thickness	t	0.7 ±0.2	0.7 ±0.2	0.7 ±0.2	0.7 ±0.2	0.7 ±0.2	0.7 ±0.2	0.7 ±0.2
Package (see also page 105)	▲	ROLL/AMMO		AMMO				
		REEL Ø360 max. Ø30 ±1 B 52 ±2 / 58 ±2 } depending on comp. dimensions		REEL Ø360 max. Ø30 ±1 B 52 ±2 / 58 ±2 or 66 ±2 REEL Ø500 max. Ø25 ±1 B 54 ±2 / 60 ±2 / 68 ±2 } depending on PCM and component dimensions				
Unit		see details page 107.						

▲ Please give „H" dimensions and desired packaging type when ordering.
▪ Diameter of leads see General Data.
* PCM 10 and PCM 15 can be crimped to PCM 7.5.
Position of components according to PCM 7.5 (sketch 1). P_0 = 12.7 or 15.0 is possible

Dims in mm.
Please clarify customer-specific deviations with the manufacturer.

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