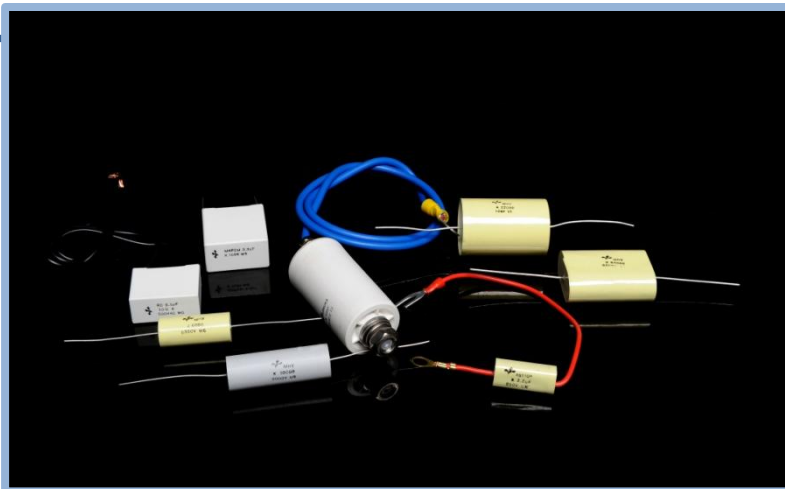


Polyester capacitors

Polyester capacitors

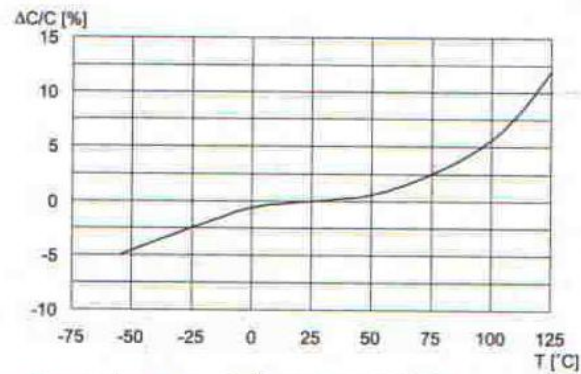


DIELECTRIC	METALLIZED POLYESTER (MKT)						POLYESTER FILM FOIL (KT)
Series	MB	MB/5	MPR	MPA	MCM*	MHV	NCM
Capacitance range (μF)	0.001 ÷ 22	0.001 ÷ 2.2	0.001 ÷ 22	0.001 ÷ 22	0.001 ÷ 22	0.001 ÷ 0.57	0.0001 ÷ 0,47
Capacitance tolerance (+/- %)	5, 10, 20	5, 10, 20	5, 10, 20	5, 10, 20	5, 10, 20	5, 10, 20	5, 10, 20
Rated voltage							
▪ Vdc	63 ÷ 1000	50 ÷ 400	63 ÷ 1000	63 ÷ 1000	63 ÷ 1000	1500 ÷ 10000	160 ÷ 630
▪ Vac	40 ÷ 250	30 ÷ 200	40 ÷ 250	40 ÷ 250	40 ÷ 250	-	90 ÷ 220
Pulse rise time (V/μs)	1 ÷ 60	4 ÷ 40	1 ÷ 50	1 ÷ 50	1 ÷ 50	10 ÷ 50	250 ÷ 3000
Lead spacing mm	7.5 ÷ 27.5	5	7.5 ÷ 27.5	AXIAL	AXIAL	AXIAL	AXIAL
Encapsulation	Potted with epoxy resin	Potted with epoxy resin	Plastic wrapped and epoxy resin filled	Plastic wrapped and epoxy resin filled	Plastic wrapped and epoxy resin filled	Plastic wrapped and epoxy resin filled	Plastic wrapped and epoxy resin filled
Climatic category acc.to IEC 60068	55/100/56	55/100/56	55/100/56	55/100/56	55/100/56	55/100/56	55/100/56
Packing	Bulk	Bulk,Taped	Bulk	Bulk	Bulk, Taped	Bulk	Bulk
International standard	IEC 60384-2	IEC 60384-2	IEC 60384-2	IEC 60384-2	IEC 60384-2	IEC 60384-2	IEC 60384-11

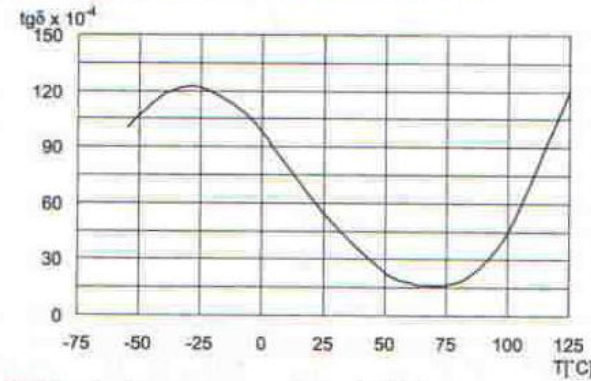
* Available 4 leads version (MCM/4)

Typical curves

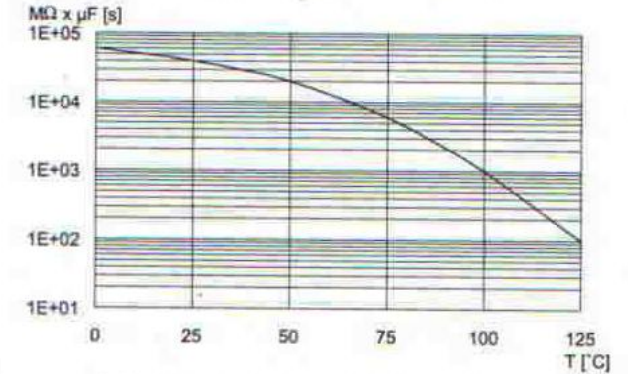
Polyester capacitors



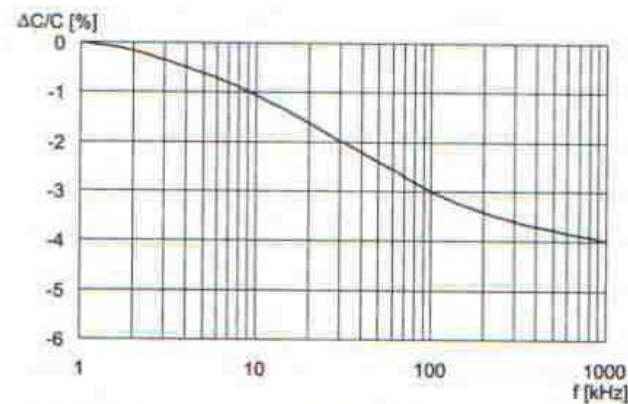
Capacitance variation as a function of temperature at 1 KHz



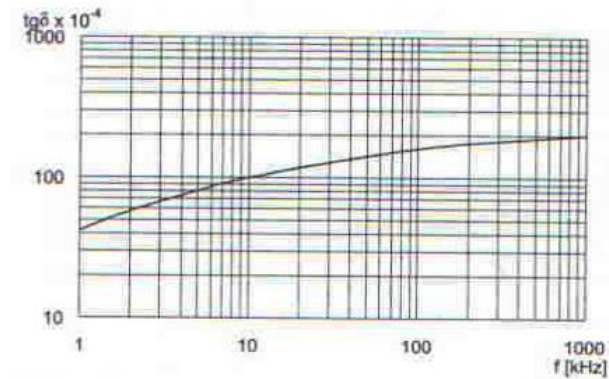
Dissipation factor variation as a function of temperature at 1 KHz



Insulation resistance as a function of temperature



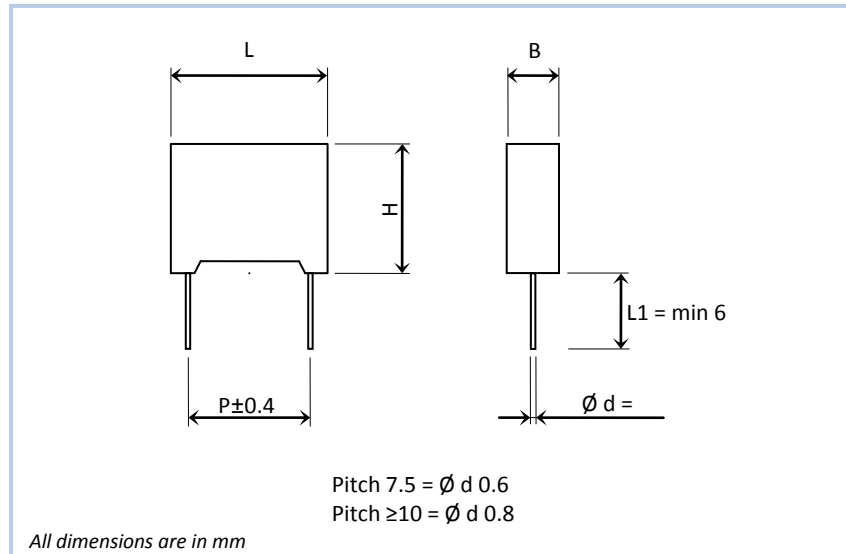
Capacitance resistance as a function of frequency (room temperature)



Dissipation factor variation as a function of frequency

Type MB

Polyester capacitors



GENERAL TECHNICAL DATA

Dielectric	polyester film
Plates	aluminium layer deposited by evaporation under vacuum
Winding	non-inductive type
Leads	tinned copper wire
Construction	radial leads, box type
Protection	plastic case, made of solvent resistant material, sealed with epoxy resin
Marking	manufacturer's name or logo, type, capacitance, tolerance, D.C. rated voltage and manufacturing date code
Climatic category	55/100/56 IEC 60068-1
Standard references	IEC 60384-2

ELECTRICAL CHARACTERISTICS

Rated voltage (Vr)	63 Vdc - 100 Vdc- 250 Vdc- 400 Vdc - 630 Vdc- 1000 Vdc					
Category voltage (Vc)	up to 85 °C Vc = Vr					
<i>For temperature between +85 °C and +100 °C a decreasing factor of 1.25% per degree °C on the rated voltage (dc and ac) has to be applied</i>						
Capacitance values	normal values in compliance with IEC standard series E6 - E12 - E24 - E48 - E96(IEC 60063 Norm) <i>Other values available upon request</i>					
Capacitance tolerances	±5% (J) ; ±10% (K) ; ±20% (M) measured at 1 kHz					
Total self-inductance (L)	Pitch (mm)	7.5	10	15	22.5	27.5
Lead length ~ 2mm	L (nH) ≈	8	9	10	18	18
Dissipation factor (tgδ) At +25°C ±5°C	≤ 80 x 10 ⁻⁴ at 1kHz for C≤ 1µF ≤ 100 x 10 ⁻⁴ at 1kHz for C> 1µF					
Insulation resistance	for Vr> 100 Vdc:	≥ 30000 MΩ for C ≤ 0.33 µF ≥ 10000 s for C > 0.33 µF				
	for Vr≤ 100 Vdc:	≥ 3750 MΩ for C ≤ 0.33 µF ≥ 1250 s for C > 0.33 µF				
Test conditions	Temperature: +25°C ±5°C Voltage charge time: 1 min Voltage charge: 50V for Vr<100Vdc and 100V for Vr≥100Vdc					
Test voltage between terminals	1.6 x Vr applied for 2 s at 25 °C ±5 °C					

		Pitch (mm)				
Maximum pulse rise time (V/ μs)	Vr	7.5	10	15	22.5	27.5
	63	5	3	1.5	1	1
	100	6	6	3	2	1
	160	15	8	5	3	2
	250	15	11	7	4	3
	400	30	20	10	5.5	5
	630	40	30	15	8	7
	1000		60	25	15	10

If the working voltage (V) is lower than the rated voltage (Vr), the capacitor can work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value with the ratio Vr/V

Reliability	at temperature +40 °C and voltage applied 0.5 x Vr				
Failure rate	$\leq 2 \text{ FIT}$ for 7.5 mm pitch $\leq 5 \text{ FIT}$ for others pitches (1 Fit = 1×10^{-9} failure/comp. x h)				
Failure criteria	short or open circuit capacitance change $ \Delta C/C > 10\%$; dissipation factor change $\Delta \text{tg}\delta > 2 \times \text{initial limit}$ insulation resistance $> 0.005 \times \text{initial limit}$				

Type MB

Polyester capacitors

QUALITY TEST			
Damp heat test	at temperature + 40 °C ± 2°C, RH 93% ± 2% , test duration 56 days capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ at 1 kHz insulation resistance $\geq 50\%$ of initial limit	Soldering	test IEC 60068-2-20 TB method 1A, solder bath at 260 °C ± 5 °C for 10 s ± 1 s (with heat screen) capacitance change $ \Delta C/C \leq 2\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ for C ≤ 1 µF at 10 kHz $\leq 30 \times 10^{-4}$ for C > 1 µF at 1 kHz insulation resistance $\geq$ initial limit
Long term stability	at standard environmental conditions after 2 years capacitance change $ \Delta C/C $ $\leq 3\%$ for C ≤ 0.1 µF $\leq 2\%$ for C > 0.1 µF	Life test	at temperature +85 °C ± 2° C , voltage applied 1.25 x Vr(d.c.), test duration 2000 h capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ for C ≤ 1 µF at 10 kHz $\leq 30 \times 10^{-4}$ for C > 1 µF at 1 kHz insulation resistance $\geq 50\%$ initial limit

Rated Capacitance	63 Vdc - 40 Vac				100 Vdc - 63 Vac				250 Vdc - 160 Vac				400 Vdc - 200 Vac				630 Vdc - 220 Vac*				1000 Vdc - 250 Vac*			
	B	H	L	P	B	H	L	P	B	H	L	P	B	H	L	P	B	H	L	P	B	H	L	P
1000 pF																					4	9	13	10
1500																					4	9	13	10
2200																					4	9	13	10
3300																					4	9	13	10
4700																	4	9	13	10	5	11	13	10
6800																	4	9	13	10	6	12	13	10
0.01 µF																	4	9	13	10	5	11	18	15
0.015													4	9	13	10	5	11	13	10	6	12	18	15
0.022													4	9	13	10	5	11	13	10	7.5	13.5	18	15
0.033													4	9	13	10	5	11	18	15	6	15	27	22.5
0.047													5	11	18	15	6	12	18	15	7	16	27	22.5
0.068									4	9	13	10	5	11	18	15	7.5	13.5	18	15	8.5	17	27	22.5
0.1									4	9	13	10	6	12	18	15	6	15	27	22.5	10	18.5	27	22.5
0.15									4	9	13	10	7.5	13.5	18	15	7	16	27	22.5	11	20	32	27.5
0.22									4	9	13	10	6	15	27	22.5	8.5	17	27	22.5	13	22	32	27.5
0.33					5	11	18	15	7.5	13.5	18	15	7	16	27	22.5	11	20	32	27.5	14	28	32	27.5
0.47	4	9	13	10	5	11	18	15	6	15	27	22.5	8.5	17	27	22.5	13	22	32	27.5	22	37	32	27.5
0.68	5	11	18	15	6	12	18	15	7	16	27	22.5	11	20	32	27.5	15	25	32	27.5	22	37	32	27.5
1	5	11	18	15	7.5	13.5	18	15	8.5	17	27	22.5	11	20	32	27.5	14	28	32	27.5				
1.5	6	12	18	15	7	16	27	22.5	11	20	32	27.5	15	25	32	27.5	22	37	32	27.5				
2.2	7.5	13.5	18	15	8.5	17	27	22.5	11	20	32	27.5	14	28	32	27.5	22	37	32	27.5				
3.3	7	16	27	22.5	10	18.5	27	22.5	13	22	32	27.5	22	37	32	27.5								
4.7	8.5	17	27	22.5	11	20	32	27.5	14	28	32	27.5	22	37	32	27.5								
6.8	10	18.5	27	22.5	13	22	32	27.5	22	37	32	27.5												
10	11	20	32	27.5	15	25	32	27.5	22	37	32	27.5												
15	15	25	32	27.5	14	28	32	27.5																
22	14	28	32	27.5	22	37	32	27.5																

Type MB

Polyester capacitors

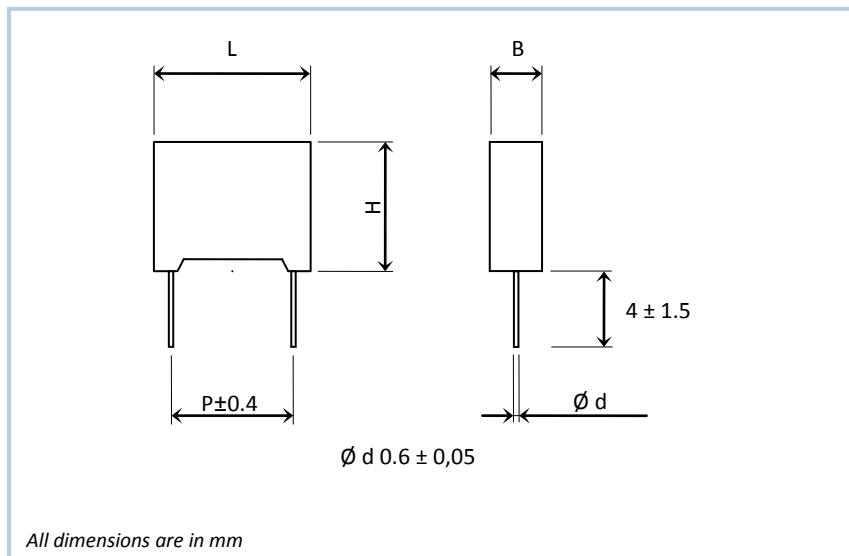
Rated	63 Vdc - 40 Vac				100 Vdc - 63 Vac				250 Vdc - 160 Vac				400 Vdc - 200 Vac				630 Vdc - 220 Vac*			
Capacitance	B	H	L	P	B	H	L	P	B	H	L	P	B	H	L	P	B	H	L	P
1000 pF																	3.5	6.5	10.5	7.5
1500																	3.5	6.5	10.5	7.5
2200																	3.5	6.5	10.5	7.5
3300													3.5	6.5	10.5	7.5	4	9	10.5	7.5
4700													3.5	6.5	10.5	7.5	4	9	10.5	7.5
6800													3.5	6.5	10.5	7.5	4	9	10.5	7.5
0.01 µF									3.5	6.5	10.5	7.5	4	9	10.5	7.5	5	11	10.5	7.5
0.015									3.5	6.5	10.5	7.5	4	9	10.5	7.5	6	12	10.5	7.5
0.022									3.5	6.5	10.5	7.5	5	11	10.5	7.5				
0.033					3.5	6.5	10.5	7.5	4	9	10.5	7.5	6	12	10.5	7.5				
0.047					3.5	6.5	10.5	7.5	4	9	10.5	7.5								
0.068	3.5	6.5	10.5	7.5	4	9	10.5	7.5	5	11	10.5	7.5								
0.1	3.5	6.5	10.5	7.5	4	9	10.5	7.5	5	11	10.5	7.5								
0.15	3.5	6.5	10.5	7.5	4	9	10.5	7.5	6	12	10.5	7.5								
0.22	4	9	10.5	7.5	5	11	10.5	7.5												
0.33	4	9	10.5	7.5	5	12	10.5	7.5												
0.47	5	11	10.5	7.5																
0.68	5	11	10.5	7.5																
1	6	12	10.5	7.5																

All dimensions are in mm

* Not suitable for across-the-line applications

Type MB/5

Polyester capacitors



GENERAL TECHNICAL DATA

Dielectric	polyester film
Plates	aluminium layer deposited by evaporation under vacuum
Winding	non-inductive type
Leads	tinned copper wire
Construction	radial leads, box type
Protection	plastic case, made of solvent resistant material, sealed with epoxy resin
Marking	capacitance, tolerance, DC rated voltage
Climatic category	55/100/56 IEC 60068-1
Standard references	IEC 60384-2

ELECTRICAL CHARACTERISTICS

Rated voltage (Vr)	50 Vdc - 63 Vdc - 100 Vdc - 250 Vdc - 400 Vdc
Category voltage (Vc)	up to 85 °C Vc = Vr
<i>For temperature between +85 °C and +100 °C a decreasing factor of 1.25% per degree °C on the rated voltage (dc and ac) has to be applied</i>	
Capacitance values	normal values in compliance with IEC standard series E6 (IEC 60063 Norm)
Capacitance tolerances	$\pm 5\%$ (J) ; $\pm 10\%$ (K) ; $\pm 20\%$ (M) measured at 1 kHz
Total self-inductance (L)	≈ 7 nH
Lead length ~ 2mm	
Dissipation factor (tgδ)	$\leq 80 \times 10^{-4}$ at 1 kHz for $C \leq 1 \mu\text{F}$ $\leq 100 \times 10^{-4}$ at 1 kHz for $C > 1 \mu\text{F}$ $\leq 150 \times 10^{-4}$ at 10 kHz $\leq 300 \times 10^{-4}$ at 100 kHz for $C \leq 0.1 \mu\text{F}$
At +25°C ±5°C	
Insulation resistance	for Vr > 100 Vdc: ≥ 30000 MΩ for Vr ≤ 100 Vdc: ≥ 15000 MΩ for C ≤ 0.33 μF ≥ 5000 MΩ for C > 0.33 μF and ≤ 1 μF ≥ 1000 s for C > 1 μF
Test conditions	Temperature: +25°C ±5°C Voltage charge time: 1 min Voltage charge : 50V for Vr<100Vdc and 100V for Vr≥100Vdc
Test voltage between terminals	1.6 x Vr applied for 2 s at 25 °C ±5 °C

	L max (mm)		
Maximum pulse rise time (V/μs)	Vr	C	V/ μs
	50 V	all	4
	63 V	all	8
	100 V	C>6800 pF	10
		3300< C≤6800 pF	15
		C≤3300 pF	30
	250 V	all	20
	400 V	all	40

If the working voltage (V) is lower than the rated voltage (Vrn), the capacitor can work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value with the ratio Vr/V

Reliability	at temperature +40 °C and voltage applied 0.5 x Vr
Failure rate	≤ 1 FIT (1 Fit = 1×10^{-9} failure/comp. x h)
Failure criteria	short or open circuit capacitance change $ \Delta C/C > 10\%$; dissipation factor change $\Delta \text{tg} \delta > 2 \times$ initial limit insulation resistance $> 0.005 \times$ initial limit

Type MB/5

Polyester capacitors

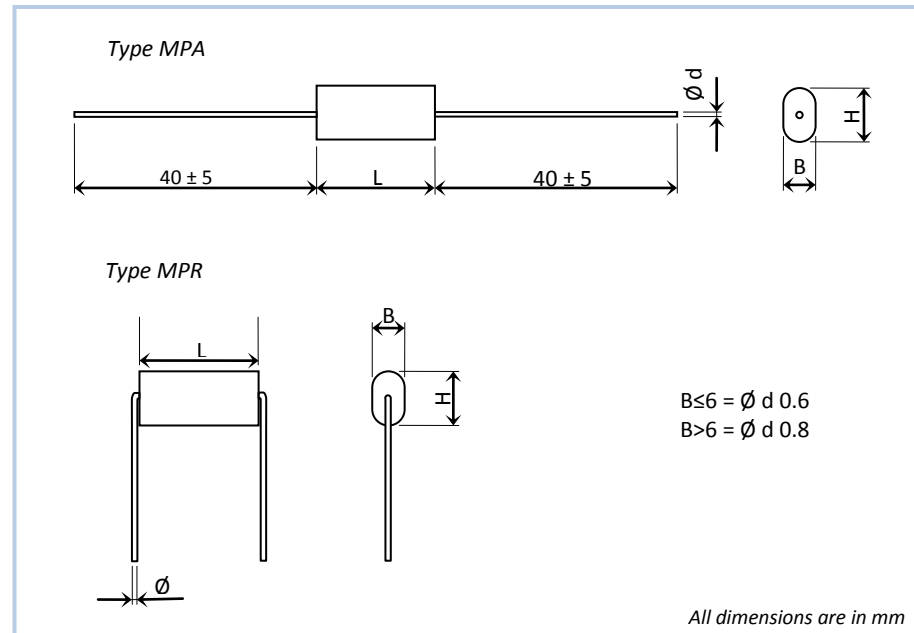
QUALITY TEST			
Damp heat test	at temperature + 40 °C ± 2°C, RH 93% ± 2% , test duration 56 days capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ at 1 kHz insulation resistance $\geq 50\%$ of initial limit	Soldering	test IEC 60068-2-20 TB method 1A, solder bath at 260 °C ± 5 °C for 10 s ± 1 s (with heat screen) capacitance change $ \Delta C/C \leq 2\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for $C \leq 1 \mu\text{F}$ at 10 kHz $\leq 20 \times 10^{-4}$ for $C > 1 \mu\text{F}$ at 1 kHz insulation resistance $\geq$ initial limit
Long term stability	at standard environmental conditions after 2 years capacitance change $ \Delta C/C \leq 3\%$	Life test	at temperature +85 °C ± 2° C , voltage applied 1.25 x Vr(d.c.), test duration 2000 h capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for $C \leq 1 \mu\text{F}$ at 10 kHz $\leq 20 \times 10^{-4}$ for $C > 1 \mu\text{F}$ at 1 kHz insulation resistance $\geq 50\%$ initial limit

Rated	50 Vdc - 30 Vac			63 Vdc - 40 Vac			100 Vdc - 63 Vac			250 Vdc - 160 Vac			400 Vdc - 200 Vac		
Capacitance	B	H	L	B	H	L	B	H	L	B	H	L	B	H	L
1000 pF							2.5	6.5	7.2				2.5	6.5	7.2
1500							2.5	6.5	7.2				2.5	6.5	7.2
2200							2.5	6.5	7.2				2.5	6.5	7.2
3300							2.5	6.5	7.2				2.5	6.5	7.2
4700							2.5	6.5	7.2				2.5	6.5	7.2
6800							2.5	6.5	7.2	2.5	6.5	7.2	3.5	7.5	7.2
0.01 µF							2.5	6.5	7.2	2.5	6.5	7.2	3.5	7.5	7.2
0.015							2.5	6.5	7.2	2.5	6.5	7.2	4.5	9.5	7.2
0.022							2.5	6.5	7.2	3.5	7.5	7.2	4.5	9.5	7.2
0.033							2.5	6.5	7.2	3.5	7.5	7.2	5	10	7.2
0.047							2.5	6.5	7.2	4.5	9.5	7.2	6	11	7.2
0.068							2.5	6.5	7.2	4.5	9.5	7.2			
0.1				2.5	6.5	7.2	2.5	6.5	7.2	5	10	7.2			
0.15				2.5	6.5	7.2	3.5	7.5	7.2	6	11	7.2			
0.22				2.5	6.5	7.2	3.5	7.5	7.2						
0.33				3.5	7.5	7.2	4.5	9.5	7.2						
0.47				3.5	7.5	7.2	4.5	9.5	7.2						
0.68				4.5	9.5	7.2	5	10	7.2						
1				5	10	7.2	6	11	7.2						
1.5				6	11	7.2									
2.2	6	11	7.2												

All dimension are in mm

Type MPA - MPR

Polyester capacitors



GENERAL TECHNICAL DATA

Dielectric	polyester film
Plates	aluminium layer deposited by evaporation under vacuum
Winding	non-inductive type
Leads	tinned copper wire
Construction	axial leads, flat type for type MPA ; radial leads, flat type for type MPR
Protection	polyester wrapping sealed with epoxy resin
Marking	manufacturer's name or logo, type, capacitance, tolerance, D.C. rated voltage and manufacturing date code
Climatic category	55/100/56 IEC 60068-1
Standard references	IEC 60384-2

ELECTRICAL CHARACTERISTICS

Rated voltage (Vr) 63 Vdc - 100 Vdc - 250 Vdc - 400 Vdc - 630 Vdc - 1000 Vdc

Category voltage (Vc) up to 85 °C Vc = Vr

For temperature between +85 °C and +100 °C a decreasing factor of 1.25% per degree °C on the rated voltage (dc and ac) has to be applied

Capacitance values normal values in compliance with IEC standard series

E6 - E12 - E24 - E48 - E96 (IEC 60063 Norm)

Other values available upon request

Capacitance tolerances $\pm 5\%$ (J) ; $\pm 10\%$ (K) ; $\pm 20\%$ (M) measured at 1 kHz

Total self-inductance (L) max 1 nH per 1 mm lead and capacitor length

Dissipation factor (tg δ) $\leq 80 \times 10^{-4}$ at 1 kHz for C $\leq 1 \mu\text{F}$

At +25°C $\pm 5^\circ\text{C}$ $\leq 100 \times 10^{-4}$ at 1 kHz for C $> 1 \mu\text{F}$

Insulation resistance for Vr > 100 Vdc: $\geq 30000 \text{ M}\Omega$ for C $\leq 0.33 \mu\text{F}$
 $\geq 10000 \text{ sec.}$ for C $> 0.33 \mu\text{F}$
 for Vr $\leq 100 \text{ Vdc}$: $\geq 3750 \text{ M}\Omega$ for C $\leq 0.33 \mu\text{F}$
 $\geq 1250 \text{ s}$ for C $> 0.33 \mu\text{F}$

Test conditions

Temperature: +25°C $\pm 5^\circ\text{C}$

Voltage charge time: 1 min

Voltage charge: 50V for Vr < 100Vdc and 100V for Vr $\geq 100 \text{ Vdc}$

Test voltage between terminals

1.6 x Vr applied for 2 s at 25°C $\pm 5^\circ\text{C}$

Maximum pulse rise time (V/ μs)	L max (mm)			
	Vr	≤ 16.5	17-20.5	25-28
63		4	2	1.5
100		5	3	2
250		10	7	4
400		13.5	10	6.5
630		20	15	10
1000		50	30	15

If the working voltage (V) is lower than the rated voltage (Vr), the capacitor can work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value with the ratio Vr/V

Reliability

at temperature +40 °C and voltage applied 0.5 x Vr

Failure rate $\leq 5 \text{ FIT}$

(1 Fit = 1×10^{-9} failure/comp. x h)

Failure criteria short or open circuit

capacitance change $|\Delta C/C| > 10\%$;

dissipation factor change $\Delta \text{tg}\delta > 2 \times \text{initial limit}$

Type MPA - MPR

Polyester capacitors

QUALITY TEST

Damp heat test	at temperature + 40 °C ± 2°C, RH 93% ± 2% , test duration 56 days capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ at 1 kHz insulation resistance $\geq 50\%$ of initial limit	Soldering	test IEC 60068-2-20 TB method 1A, solder bath at 260 °C ± 5 °C for 10 s ± 1 s (with heat screen) capacitance change $ \Delta C/C \leq 2\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for C ≤ 1 µF at 10 kHz $\leq 20 \times 10^{-4}$ for C > 1 µF at 1 kHz insulation resistance $\geq$ initial limit
Long term stability	at standard environmental conditions after 2 years capacitance change $ \Delta C/C $ $\leq 3\%$ for C ≤ 0.1 µF $\leq 2\%$ for C > 0.1 µF	Life test	at temperature +85 °C ± 2° C , voltage applied 1.25 x Vr(d.c.), test duration 2000 h capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for C ≤ 1 µF at 10 kHz $\leq 20 \times 10^{-4}$ for C > 1 µF at 1 kHz insulation resistance $\geq 50\%$ initial limit

Rated Capacitance	63 Vdc - 40 Vac				100 Vdc - 63 Vac				250 Vdc - 160 Vac				400 Vdc - 200 Vac				630 Vdc - 220 Vac*				1000 Vdc - 250 Vac*			
	B	H	L	P**	B	H	L	P**	B	H	L	P**	B	H	L	P**	B	H	L	P**	B	H	L	P**
1000 pF																					4	8	10	7.5
1500																					4	8	10	7.5
2200																					4	8	10	7.5
3300																					4	8	13	10
4700																					4	8	13	10
6800																					4	8	13	10
0.01 µF																					5	9	13	10
0.015													4	8	10	7.5	4	8	10	7.5	7	11	13	10
0.022													4	8	10	7.5	4	8	13	10	6.5	9	17	15
0.033													4	8	10	7.5	5	9	13	10	7	11	17	15
0.047													5	9	13	10	6	10	13	10	9	13	17	15
0.068									4	8	10	7.5	5	9	13	10	6	10	17	15	6	12	25	22.5
0.1					4	8	10	7.5	4	8	13	10	6	11	13	10	7	11	17	15	8	13	25	22.5
0.15					4	8	10	7.5	4	8	13	10	6	10	17	15	7	11	25	22.5	8.5	15	32	27.5
0.22	4	8	10	7.5	4	8	13	10	6	10	13	10	7	12	17	15	9	13	25	22.5	10	17	32	27.5
0.33	4	8	10	7.5	4	8	13	10	6	10	17	15	7	12	25	22.5	9	15	32	27.5	11	24	32	27.5
0.47	4	8	13	10	6	9	13	10	6	11	17	15	8	13	25	22.5	10	17	32	27.5	14	27	32	27.5
0.68	4	9	13	10	7	10	13	10	8	12	17	15	8	16	32	27.5	12	20	32	27.5	17	30	32	27.5
1	6	10	13	10	7	10	17	15	7	15	25	22.5	10	17	32	27.5	13	25	32	27.5	21	38	32	27.5
1.5	5.5	9.5	17	15	7	11	17	15	7	16	25	22.5	12	21	32	27.5	17	30	32	27.5				
2.2	7	11	17	15	7	12	25	22.5	10	20	25	27.5	13	22	32	27.5	21	34	32	27.5				
3.3	7	11	25	22.5	8	14	25	22.5	11	18	32	27.5	16	30	32	27.5								
4.7	7	12.5	25	22.5	8	15	32	27.5	12	24	32	27.5	22	34	32	27.5								
6.8	8.5	14	25	22.5	10	17	32	27.5	15	28	32	27.5												
10	9	16	32	27.5	11.5	21	32	27.5	18	32	32	27.5												
15	11	20	32	27.5	13	26	32	27.5																
22	13.5	26.5	32	27.5	17	30	32	27.5																

L	L±	B±	H	H±
10	1	≤6	1	≤8
13	1.5			
17	1.5	≤12	1.5	≤14
25	2			
32	2	≤20	2	≤35

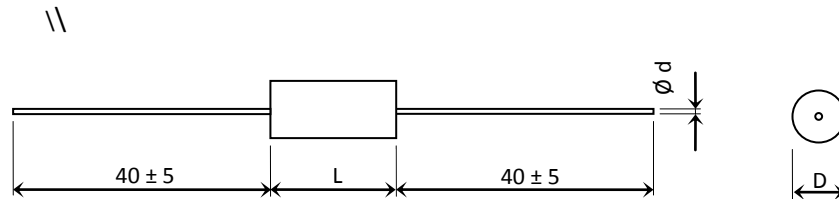
All dimension are in mm.

*Not suitable for across-the-line applications

** Only for MPR

Type MCM

Polyester capacitors



$D \leq 6 = \varnothing d 0.6$
 $D > 6.5 = \varnothing d 0.8$
 $L \geq 44 = \varnothing d 1$
 Version 4 leads also available

All dimensions are in mm

GENERAL TECHNICAL DATA

Dielectric	polyester film
Plates	aluminium layer deposited by evaporation under vacuum
Winding	non-inductive type
Leads	tinned copper wire
Construction	axial leads, cylindrical type
Protection	polyester wrapping sealed with epoxy resin
Marking	manufacturer's name or logo, type, capacitance, tolerance, D.C. rated voltage and manufacturing date code
Climatic category	55/100/56 IEC 60068-1
Standard references	IEC 60384-2

ELECTRICAL CHARACTERISTICS

Rated voltage (Vr) 63 Vdc - 100 Vdc - 250 Vdc - 400 Vdc - 630 Vdc - 1000 Vdc

Category voltage (Vc) up to 85 °C Vc = Vr

For temperature between +85 °C and +100 °C a decreasing factor of 1.25% per degree °C on the rated voltage (dc and ac) has to be applied

Capacitance values normal values in compliance with IEC standard series
E6 - E12 - E24 - E48 - E96 (IEC 60063 Norm)
Other values available upon request

Capacitance tolerances $\pm 5\%$ (J) ; $\pm 10\%$ (K) ; $\pm 20\%$ (M) measured at 1 kHz

Total self-inductance (L) max 1 nH per 1 mm lead and capacitor length

Dissipation factor (tg δ) $\leq 80 \times 10^{-4}$ at 1 kHz for C $\leq 1 \mu\text{F}$

At +25°C $\pm 5^\circ\text{C}$ $\leq 100 \times 10^{-4}$ at 1 kHz for C > 1 μF

Insulation resistance for Vr > 100 Vdc: $\geq 30000 \text{ M}\Omega$ for C $\leq 0.33 \mu\text{F}$
 $\geq 10000 \text{ s}$ for C > 0.33 μF
for Vr $\leq 100 \text{ Vdc}$: $\geq 3750 \text{ M}\Omega$ for C $\leq 0.33 \mu\text{F}$
 $\geq 1250 \text{ s}$ for C > 0.33 μF

Test conditions

Temperature: +25°C $\pm 5^\circ\text{C}$

Voltage charge time: 1 min

Voltage charge: 50V for Vr < 100Vdc and 100V for Vr $\geq 100 \text{ Vdc}$

Test voltage between terminals 1.6 x Vr applied for 2 s at 25°C $\pm 5^\circ\text{C}$.

L max (mm)

Maximum pulse rise time (V/ μs)	Vr	≤ 14.5	18.5	27	34	40	59
63	4	2	1.5	1			
100	5	3	2	1	1		
250	10	7	4	2.5	2		
400	13.5	10	6.5	4	3		
630	20	15	10	6	4	2	
1000	50	30	15	10	8	6	

If the working voltage (V) is lower than the rated voltage (Vr), the capacitor can work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value with the ratio Vr/V

Reliability at temperature +40 °C and voltage applied 0.5 x Vr

Failure rate $\leq 1 \text{ FIT}$

(1 Fit = 1×10^{-9} failure/comp. x h)

Failure criteria short or open circuit

capacitance change $|\Delta C/C| > 10\%$;

dissipation factor change $\Delta \text{tg}\delta > 2 \times \text{initial limit}$

insulation resistance $> 0.005 \times \text{initial limit}$

Type MCM

Polyester capacitors

QUALITY TEST

Damp heat test	at temperature + 40 °C ± 2°C, RH 93% ± 2% , test duration 56 days capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ at 1 kHz insulation resistance $\geq 50\%$ of initial limit	Soldering	test IEC 60068-2-20 TB method 1A, solder bath at 260 °C ± 5 °C for 10 s ± 1 s (with heat screen) capacitance change $ \Delta C/C \leq 2\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for $C \leq 1 \mu\text{F}$ at 10 kHz $\leq 20 \times 10^{-4}$ for $C > 1 \mu\text{F}$ at 1 kHz insulation resistance $\geq$ initial limit
Long term stability	at standard environmental conditions after 2 years capacitance change $ \Delta C/C $ $\leq 3\%$ for $C \leq 0.1 \mu\text{F}$ $\leq 2\%$ for $C > 0.1 \mu\text{F}$	Life test	at temperature +85 °C ± 2° C , voltage applied 1.25 x Vr(d.c.), test duration 2000 h capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for $C \leq 1 \mu\text{F}$ at 10 kHz $\leq 20 \times 10^{-4}$ for $C > 1 \mu\text{F}$ at 1 kHz insulation resistance $\geq 50\%$ initial limit

Rated Capacitance	63 Vdc - 40 Vac		100 Vdc - 63 Vac		250 Vdc - 160 Vac		400 Vdc - 200 Vac		630 Vdc - 220 Vac*		1000 Vdc - 250 Vac*	
	D	L	D	L	D	L	D	L	D	L	D	L
1000 pF											5	13
1500											5	13
2200											5	13
3300									5.5	11	5	13
4700							5	11	5.5	13	5.5	13
6800							5	11	5.5	13	6	13
0.01 μF							5	11	5.5	13	6	17
0.015							6	11	6	13	6.5	17
0.022							5	13	6	13	8.5	17
0.033					6	11	5	13	7	17	7	25
0.047					6	13	6	13	8	17	8	25
0.068					6	13	7	13	9	17	9	25
0.1	5.5	11	6	11	6	13	7	17	10	17	11	25
0.15	6.5	11	5	13	6.5	13	9	17	8.5	25	12	32
0.22	6	13	6	13	7	17	7	25	11	25	14	32
0.33	6.5	13	6	17	8	17	8.5	25	13	25	17	32
0.47	7	13	7	17	9	17	9.5	25	14	32	20	32
0.68	6	17	8.5	17	8	25	11	32	16	32	24	32
1	7	17	10	17	10	25	13	32	20	32	23	44
1.5	8	17	8	25	10	32	16	32	24	32	28	44
2.2	8	25	10	25	12	32	20	32	30	32	33	57
3.3	9	25	11	25	14	32	24	32	28	44		
4.7	12	25	12	32	17	32	22	44	30	57		
6.8	13	32	15	32	22	32	26	44				
10	15.5	32	18	32	25	32						
15	19	32	22	32	24	44						
15			16	44								
22	22	32	25	32	30	44						
22			19	44								

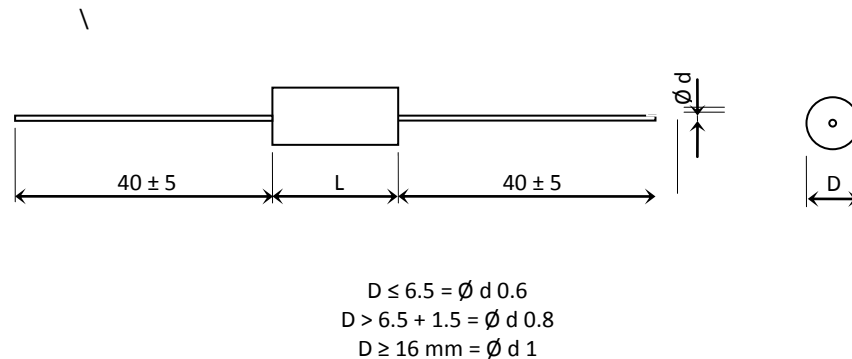
All dimension are in mm

* Not suitable for across-the-line applications

DIMENSION TOLERANCE		
L	L±	D±
10	1	1
13	1.5	1
17	1.5	1.5
25	2	1.5
32	2	2
44	2	2
57	2	2

Type MHV

Polyester capacitors



GENERAL TECHNICAL DATA

Dielectric	polyester film
Plates	aluminium layer deposited by evaporation under vacuum
Winding	non-inductive type
Leads	tinned copper wire
Construction	axial leads, cylindrical type
Protection	polyester wrapping sealed with epoxy resin
Marking	manufacturer's name or logo, type, capacitance, tolerance, D.C. rated voltage and manufacturing date code
Climatic category	55/100/56 IEC 60068-1
Standard references	IEC 60384-2

ELECTRICAL CHARACTERISTICS

Rated voltage (Vr) 1500 Vdc - 2500 Vdc - 4000 Vdc - 6300 Vdc - 10000 Vdc

Category voltage (Vc) up to 85 °C Vc = Vr

For temperature between +85 °C and +100 °C a decreasing factor of 1.25% per degree °C on the rated voltage (dc and ac) has to be applied

Capacitance values normal values in compliance with IEC standard series
E6 - E12 - E24 - E48 - E96 (IEC 60063 Norm)
Other values available upon request

Capacitance tolerances ±5% (J) ; ±10% (K) ; ±20% (M) measured at 1 kHz

Total self-inductance (L) max 1 nH per 1 mm lead and capacitor length

Dissipation factor (tgδ) ≤ 80 x 10⁻⁴ at 1 kHz for C ≤ 1μF
At +25°C ±5°C ≤ 100 x 10⁻⁴ at 1 kHz for C > 1μF

Insulation resistance ≥ 150000 MΩ for C ≤ 0.33 μF
≥ 5000 s for C > 0.33 μF

Test conditions Temperature: +25°C ±5°C
Voltage charge time: 1 min
Voltage charge: 50V for Vr < 100Vdc and 100V for Vr ≥ 100Vdc

Test voltage between terminals (Vp) 1.4 x Vr for Vr = 1500 and 2500
1.2 x Vr for Vr = 4000, 6300, 10000
For 2 s at +25°C ±5°C

L max (mm)

Maximum pulse rise time (V/μs)

Vr	≤27	34	50
1500	20	15	10
2500	30	20	15
4000	40	30	20
6300		40	30
10000			30

If the working voltage (V) is lower than the rated voltage (Vr), the capacitor can work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value with the ratio Vr/V

Type MHV

Polyester capacitors

QUALITY TEST			
Damp heat test	at temperature + 40 °C ± 2°C, RH 93% ± 2% , test duration 56 days capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 50 \times 10^{-4}$ at 1 kHz insulation resistance $\geq 50\%$ of initial limit	Soldering	test IEC 60068-2-20 TB method 1A, solder bath at 260 °C ± 5 °C for 10 s ± 1 s (with heat screen) capacitance change $ \Delta C/C \leq 2\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for $C \leq 1 \mu\text{F}$ at 10 kHz $\leq 20 \times 10^{-4}$ for $C > 1 \mu\text{F}$ at 1 kHz insulation resistance $\geq$ initial limit
Long term stability	at standard environmental conditions after 2 years capacitance change $ \Delta C/C $ $\leq 3\%$ for $C \leq 0.1 \mu\text{F}$ $\leq 2\%$ for $C > 0.1 \mu\text{F}$	Life test	at temperature +85 °C ± 2° C , voltage applied 1.25 x Vr(d.c.), test duration 2000 h capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 30 \times 10^{-4}$ for $C \leq 1 \mu\text{F}$ at 10 kHz $\leq 20 \times 10^{-4}$ for $C > 1 \mu\text{F}$ at 1 kHz insulation resistance $\geq 50\%$ initial limit

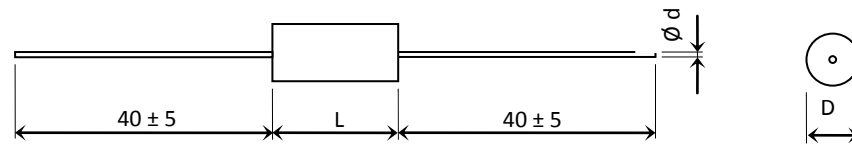
Rated	1500 Vdc		2500 Vdc		4000 Vdc		6300 Vdc		10000 Vdc	
Capacitance	D	L	D	L	D	L	D	L	D	L
1000 pF	6	15	7	26	8	26	8	32	10	48
1500	6.5	15	7	26	8	26	8	32	12	48
2200	6.5	15	7	26	8	26	10	32	13	48
3300	7	15	8.5	26	10	26	11.5	32	16	48
4700	8	15	8.5	26	11	26	14	32	18.5	48
6800	9	15	9.5	26	13	26	16	32	21.5	48
0.01 μF	7.5	19	11	26	12.5	32	18.5	32	25.5	48
0.015	9	19	14	26	15	32	21.5	32	31	48
0.022	10.5	19	12.5	32	17.5	32	20	48	37	48
0.033	12.5	19	15	32	21	32	24	48		
0.047	10.5	26	17	32	25.5	32	29	48		
0.068	12.5	26	21	32	23	48	34	48		
0.1	15	26	24.5	32	28	48				
0.15	16	32	23	48	33	48				
0.22	18.5	32	28	48						
0.33	22.5	32	33	48						
0.47	21.5	48								

All dimension are in mm

DIMENSION TOLERANCE		
L	L±	D±
15	1.5	1
19	1.5	1.5
25	2	1.5
≥32	2	2

Type NCM

Polyester capacitors



$D \leq 7 \text{ mm} = \varnothing d 0.6 \text{ mm}$
 $D > 7 \text{ mm} = \varnothing d 0.8 \text{ mm}$

GENERAL TECHNICAL DATA

Dielectric	polyester film
Plates	tin-foil
Winding	non-inductive type
Leads	tinned copper wire
Construction	axial leads, cylindrical type
Protection	polyester wrapping sealed with epoxy resin
Marking	manufacturer's name or logo, type, capacitance, tolerance, D.C. rated voltage and manufacturing date code
Climatic category	55/100/56 IEC 60068-1
Standard references	IEC 60384-11

ELECTRICAL CHARACTERISTICS

Rated voltage (Vr)	160 Vdc - 250 Vdc - 400 Vdc - 630 Vdc					
Category voltage (Vc)	up to 85 °C Vc = Vr					
<i>For temperature between +85 °C and +100 °C a decreasing factor of 1.25% per degree °C on the rated voltage (dc and ac) has to be applied</i>						
Capacitance values	normal values in compliance with IEC standard series E6 - E12 - E24 - E48 - E96 (IEC 60063 Norm) <i>Other values available upon request</i>					
Capacitance tolerances	±5% (J) ; ±10% (K) ; ±20% (M) measured at 1 kHz					
Total self-inductance (L)	max 1 nH per 1 mm lead and capacitor length					
Dissipation factor (tgδ) At +25°C ±5°C	≤ 80 x 10 ⁻⁴ at 1 kHz					
Insulation resistance	≥ 50000 MΩ					
Test conditions	<i>Temperature: +25°C ±5°C Voltage charge time: 1 min Voltage charge: 100V</i>					
Test voltage between terminals (Vp)	2.5 x Vr applied for 2 s at 25° C ± 5° C					
Maximum pulse rise time (V/μs)	L max (mm)					
	Vr	12.5	16.5	20.5	27	34
	160	1500	600	400	250	200
	250	1500	600	400	250	200
	400	3000	1000	650	350	350
	630	-	1500	750	450	450

If the working voltage (V) is lower than the rated voltage (Vr), the capacitor can work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value with the ratio Vr/V

Type NCM

Polyester capacitors

QUALITY TEST			
Damp heat test	at temperature + 40°C ± 2°C, RH 93% ± 2% , test duration 56 days capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change ($\Delta \text{tg}\delta$) 1.2 times the initial limit or $\leq$ the initial limit whichever is greater insulation resistance $\geq 50\%$ of initial limit	Soldering	test IEC 60068-2-20 TB method 1A, solder bath at 260 °C ± 5 °C for 10 s ± 1 s (with heat screen) capacitance change $ \Delta C/C \leq 5\%$ dissipation factor $\leq$ initial limit insulation resistance $\geq$ initial limit
Long term stability	at standard environmental conditions after 2 years capacitance change $ \Delta C/C $ $\leq 3\%$ for $C \leq 0.1 \mu\text{F}$ $\leq 2\%$ for $C > 0.1 \mu\text{F}$	Life test	at temperature +85 °C ± 2° C , voltage applied $1.1 \times V_r$ (d.c.), test duration 1000 h capacitance change $ \Delta C/C \leq 5\%$ dissipation factor change $\Delta \text{tg}\delta \leq 1.2$ times the initial value or $\leq$ the initial limit whichever is greater insulation resistance $\geq 50\%$ initial limit

Rated Capacitance	160 Vdc - 90 Vac		250 Vdc - 120 Vac		400 Vdc - 160 Vac		630 Vdc - 220 Vac	
	D	L	D	L	D	L	D	L
100 - 1000 pF							5	15
1500							5.5	15
2200							5.5	15
3300							5.5	15
4700			5	11	5.5	15	6	15
6800	5	11	5	15	6	15	7	15
0.01 μF	5	11	6	15	7	15	6.5	19
0.015	6.5	15	6.5	15	6.5	19	7.5	19
0.022	6.5	15	6	19	7.5	19	9	19
0.033	6.5	19	7	19	9	19	11	19
0.047	7.5	19	8	19	8	25	10	25
0.068	9	19	10	19	10	25	12	25
0.1	10	19	9	25	11.5	25	14.5	25
0.15	9.5	25	11	25	11.5	32	15.5	32
0.22	11	25	12.5	25	14	32	17.5	32
0.33	11	32	13	32	17	32	25	32
0.47	13	32	15.5	32	20	32		

All dimensions are in mm

* Not suitable for across-the-line applications

DIMENSION TOLERANCE		
L	L±	D±
11	1.5	1
15	1.5	1
19	1.5	1.5
25	2	1.5
≥32	2	2