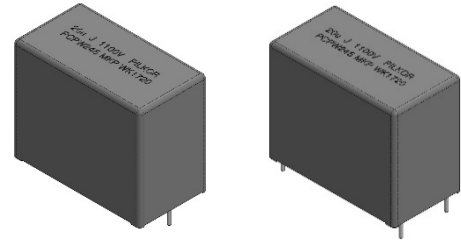


Metallized Polypropylene Film Capacitors (DC-link application)

PCPW 246

CONSTRUCTION

- Dielectric : Metallized Polypropylene film
with segmented pattern
- Case : PBT (UL94 V-0)
- Filling : Epoxy resin (UL94 V-0)
- Terminals : Tinned copper wire (2-pin / 4-pin)



FEATURE

- High capacitance density dc-link capacitor
- High safety, Self-healing and self-protecting function built in
- Low loss, Low ESR
- Long product life, high reliability
- Stable capacitance at THB conditions

APPLICATION

- For DC filtering, dc-link circuit
- HEV, EV (power train, OBC etc.)
- Renewable energies inverters
- Industrial power supplies
- Inverter circuit in appliances (air conditioner etc.)
- Motor drive

QUICK REFERENCE DATA

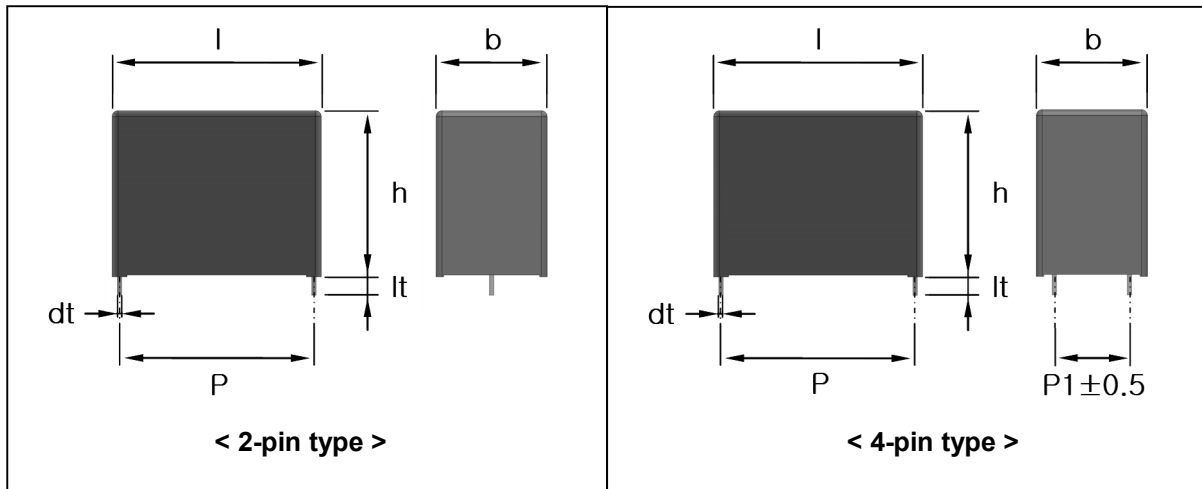
Capacitance range	1.5 μ F to 150 μ F
Capacitance tolerance	\pm 5%
Rated voltage (V_{Rdc} at 85 $^{\circ}$ C)	450Vdc to 1100Vdc
IEC Climatic category	40 / 105 / 56
Rated temperature	85 $^{\circ}$ C
Maximum permissible case temperature	105 $^{\circ}$ C (observing voltage derating)
Insulation resistance (IR)	IRxC \geq 10,000s at 100(500)V _{dc} , 1min For < 500V _{dc} , measuring voltage 100V _{dc} For \geq 500V _{dc} , measuring voltage 500V _{dc}
Withstanding voltage between terminals	1.5 x V_{Rdc} applied for 10s
Withstanding voltage between terminals and case	2KV _{AC} 50-60Hz applied for 60s
Life time expectancy	100,000 hours at V_R , 70 $^{\circ}$ C 40,000 hours at V_R , 85 $^{\circ}$ C
Reference	IEC 61071, IEC 60068

- Please refer to caution and warning at <http://www.pilkor.co.kr/download/Introductions.pdf> before using these products.

DC VOLTAGE DERATINGS

V_{Rdc} at 85 $^{\circ}$ C	450V	700V	900V	1100V			
V_{OPdc} at 70 $^{\circ}$ C	500V	840V	1080V	1320V			
V_{OPdc} at 105 $^{\circ}$ C	300V	490V	630V	770V			

Ordering Information



1	2	3	4	5	6	7	8	9	10	11	12	13	14
P	2	4	6	Q	7	0	3	0	6	J	A	S	4

1~4	
Code	Series name
P246	PCPW 246

5	
Code	Pitch
L	27.5±0.4
Q	37.5±0.7
T	52.5±0.7

6~7	
Code	Voltage
45	450V
70	700V
90	900V
11	1100V

8~10	
Code	Capacitance
105	1uF
106	10uF
107	100uF

11	
Code	Cap. tolerance
J	5%

12	
Code	Type
A	Standard
M	Automotive
L	Low profile

13	
Code	Lead length
L	25.0±1.0mm
S	5.0±1.0mm
F	4.0±0.5mm
8	3.8±0.5mm
7	3.7±0.5mm
5	3.5±0.5mm
4	3.4±0.5mm

14		
Code	Lead type	Packing
2	2-PIN	Arrange
4	4-PIN	Arrange

Arrange Packing Information

DIMENSION b X h X l (mm)	Ødt		ARRANGE	
	2-PIN	4-PIN	SPQ	PQ
11.0 x 21.0 x 31.0	0.8mm (+0.08/-0.05)	-	100	500
13.0 x 23.0 x 31.0			100	500
15.0 x 25.0 x 31.0			120	600
17.0 x 27.0 x 31.0			105	525
18.0 x 28.0 x 31.0			100	500
19.0 x 29.0 x 31.0			95	475
21.0 x 31.0 x 31.0			60	240
22.0 x 37.0 x 31.0	0.8mm (+0.08/-0.05)	0.8mm (+0.08/-0.05)	60	240
18.0 x 33.0 x 42.0	1.0mm (+0.1/-0.05)	1.2mm (+0.12/-0.05)	100	400
20.0 x 35.0 x 42.0			90	360
24.0 x 39.0 x 42.0			75	300
28.0 x 43.0 x 42.0			65	195
30.0 x 45.0 x 42.0			60	180
30.0 x 51.0 x 42.0			60	180
30.0 x 45.0 x 57.0	-	1.2mm (+0.12/-0.05)	40	120
35.0 x 50.0 x 57.0			35	105
40.0 x 53.0 x 57.0			30	90
45.0 x 55.0 x 57.0			30	60
45.0 x 65.0 x 57.0			30	60

Metallized Polypropylene Film Capacitors (DC-link application)

$V_{Rdc} = 450Vdc$ at 85°C (500Vdc at 70°C)

CAP. (μF)	Dimension (mm)			P (mm)	P1 (mm)	dv/dt (V/us)	Ipk (A)	I _{rms} ⁽¹⁾ (A)		ESR ⁽²⁾ (m Ω)		TanD ⁽³⁾ ($\times 10^{-4}$)		Part No. P246
	b	h	l					2P	4P	2P	4P	2P	4P	
4	11	21	31	27.5	-	30	120	4.7	-	12.3	-	85	-	L45405JA**
5	13	23	31	27.5	-	30	150	5.6	-	9.9	-	85	-	L45505JA**
6	15	25	31	27.5	-	30	180	6.5	-	8.5	-	85	-	L45605JA**
7	15	25	31	27.5	-	30	210	6.9	-	7.5	-	85	-	L45705JA**
8	15	25	31	27.5	-	30	240	7.4	-	6.6	-	85	-	L45805JA**
9	17	27	31	27.5	-	30	270	8.2	-	6.0	-	85	-	L45905JA**
10	18	28	31	27.5	-	30	300	8.8	-	5.5	-	85	-	L45106JA**
15	21	31	31	27.5	-	30	450	10.8	-	4.3	-	85	-	L45156JA**
20	22	37	31	27.5	10.2	30	600	13.5	12.9	3.4	3.1	85	75	L45206JA**
20	18	33	42	37.5	-	21	420	10.0	-	6.0	-	160	140	Q45206JA**
22	20	35	42	37.5	10.2	21	462	10.2	11.4	5.6	5.1	160	140	Q45226JA**
25	20	35	42	37.5	10.2	21	525	10.8	12.0	5.0	4.5	160	140	Q45256JA**
30	24	39	42	37.5	10.2	21	630	12.8	14.2	4.2	3.8	160	140	Q45306JA**
35	24	39	42	37.5	10.2	21	735	13.6	15.1	3.7	3.4	160	140	Q45356JA**
40	28	43	42	37.5	10.2	21	840	15.6	17.3	3.3	3.0	160	140	Q45406JA**
45	28	43	42	37.5	10.2	21	945	16.4	18.2	3.0	2.7	160	140	Q45456JA**
50	30	45	42	37.5	20.3	21	1050	17.8	19.8	2.7	2.5	160	140	Q45506JA**
55	30	45	42	37.5	20.3	21	1155	18.5	20.6	2.5	2.3	160	140	Q45556JA**
60	30	51	42	37.5	20.3	21	1260	20.1	22.3	2.3	2.1	160	140	Q45606JA**
60	30	45	57	52.5	20.3	14	840	-	19.2	-	3.2	-	250	T45606JA**
75	30	45	57	52.5	20.3	14	1050	-	21.2	-	2.6	-	250	T45756JA**
100	35	50	57	52.5	20.3	14	1400	-	25.9	-	2.0	-	250	T45107JA**
110	35	50	57	52.5	20.3	14	1540	-	27.0	-	1.9	-	250	T45117JA**
120	40	53	57	52.5	20.3	14	1680	-	29.6	-	1.8	-	250	T45127JA**
130	40	53	57	52.5	20.3	14	1820	-	30.5	-	1.7	-	300	T45137JA**
140	45	55	57	52.5	20.3	14	1960	-	32.5	-	1.6	-	300	T45147JA**
150	45	55	57	52.5	20.3	14	2100	-	33.1	-	1.6	-	300	T45157JA**

⁽¹⁾ Maximum RMS current at +70°C, 10KHz, $\Delta T = +15^\circ C$ (Hot spot temp. = $T_{amb} + \Delta T = 70^\circ C + 15^\circ C = 85^\circ C$)

⁽²⁾ Typical ESR values at 10KHz, 20°C
(Maximum ESR value : less than 2.5 x typical ESR value)

⁽³⁾ Maximum TanD value at 10KHz, 20°C

Capacitance	TanD ($\times 10^{-4}$) at 1KHz
P=27.5mm	≤ 10
C \leq 30 μF	≤ 15
C > 30 μF	≤ 20
C \geq 100 μF	≤ 30

Metallized Polypropylene Film Capacitors (DC-link application)

$V_{Rdc} = 700Vdc$ at 85°C (800Vdc at 70°C)

CAP. (μF)	Dimension (mm)			P (mm)	P1 (mm)	dv/dt (V/us)	Ipk (A)	I _{rms} ⁽¹⁾ (A)		ESR ⁽²⁾ (m Ω)		TanD ⁽³⁾ ($\times 10^{-4}$)		Part No. P246
	b	h	l					2P	4P	2P	4P	2P	4P	
2	11	21	31	27.5	-	40	80	3.7	-	19.9	-	65	-	L70205JA**
3	13	23	31	27.5	-	40	120	4.9	-	13.3	-	65	-	L70305JA**
4	15	25	31	27.5	-	40	160	6.0	-	9.9	-	65	-	L70405JA**
5	17	27	31	27.5	-	40	200	7.0	-	8.3	-	65	-	L70505JA**
6	18	28	31	27.5	-	40	240	7.9	-	6.9	-	65	-	L70605JA**
7	19	29	31	27.5	-	40	280	8.7	-	5.9	-	65	-	L70705JA**
8	21	31	31	27.5	-	40	320	10.1	-	4.9	-	65	-	L70805JA**
9	21	31	31	27.5	-	40	360	10.4	-	4.6	-	65	-	L70905JA**
10	22	37	31	27.5	10.2	40	100	11.8	12.4	4.1	3.7	65	55	L70106JA**
10	18	33	42	37.5	-	22	220	9.2	-	7.1	-	110	-	Q70106JA**
12	20	35	42	37.5	10.2	22	264	10.0	11.1	5.8	5.3	110	95	Q70126JA**
15	24	39	42	37.5	10.2	22	330	12.0	13.3	4.8	4.4	110	95	Q70156JA**
20	24	39	42	37.5	10.2	22	440	13.8	15.4	3.6	3.3	110	95	Q70206JA**
22	28	43	42	37.5	10.2	22	484	15.4	17.1	3.3	3.0	110	95	Q70226JA**
25	28	43	42	37.5	10.2	22	550	16.4	18.3	2.9	2.7	110	95	Q70256JA**
30	30	45	42	37.5	20.3	22	660	18.3	20.3	2.5	2.3	110	95	Q70306JA**
35	30	51	42	37.5	20.3	22	726	20.5	22.8	2.2	2.0	110	95	Q70356JA**
40	30	45	57	52.5	20.3	15	600	-	17.0	-	4.1	-	220	T70406JA**
50	35	50	57	52.5	20.3	15	750	-	20.0	-	3.4	-	220	T70506JA**
60	35	50	57	52.5	20.3	15	925	-	21.5	-	3.0	-	220	T70606JA**
70	40	53	57	52.5	20.3	15	1050	-	23.9	-	2.7	-	250	T70706JA**
80	45	55	57	52.5	20.3	15	1200	-	26.3	-	2.4	-	250	T70806JA**
90	45	65	57	52.5	20.3	15	1350	-	29.0	-	2.2	-	250	T70906JA**
100	45	65	57	52.5	20.3	15	1500	-	30.9	-	2.0	-	250	T70107JA**

⁽¹⁾ Maximum RMS current at +70°C, 10KHz, $\Delta T = +15^\circ C$ (Hot spot temp. = $T_{amb} + \Delta T = 70^\circ C + 15^\circ C = 85^\circ C$)

⁽²⁾ Typical ESR values at 10KHz, 20°C
(Maximum ESR value : less than 2.5 x typical ESR value)

⁽³⁾ Maximum TanD value at 10KHz, 20°C

Capacitance	TanD ($\times 10^{-4}$) at 1KHz
P=27.5mm	≤ 10
C \leq 30 μF	≤ 15
C > 30 μF	≤ 20
C \geq 100 μF	≤ 30

Metallized Polypropylene Film Capacitors (DC-link application)

$V_{Rdc} = 900Vdc$ at 85°C (1100Vdc at 70°C)

CAP. (μF)	Dimension (mm)			P (mm)	P1 (mm)	dv/dt (V/us)	Ipk (A)	I _{rms} ⁽¹⁾ (A)		ESR ⁽²⁾ (m Ω)		TanD ⁽³⁾ ($\times 10^{-4}$)		Part No. P246
	b	h	l					2P	4P	2P	4P	2P	4P	
1	11	21	31	27.5	-	75	75	3.1	-	28.6	-	50	-	L90105JA**
2	13	23	31	27.5	-	75	150	4.7	-	14.5	-	50	-	L90205JA**
3	15	25	31	27.5	-	75	225	6.1	-	9.8	-	50	-	L90305JA**
4	18	28	31	27.5	-	75	300	7.6	-	7.4	-	50	-	L90405JA**
5	19	29	31	27.5	-	75	375	8.7	-	6.0	-	50	-	L90505JA**
6	21	31	31	27.5	-	75	450	9.9	-	5.1	-	50	-	L90605JA**
7	22	37	31	27.5	10.2	75	525	11.4	12.0	4.4	4.0	50	45	L90705JA**
8	20	35	42	37.5	10.2	54	432	10.6	-	5.8	-	90	-	Q90805JA**
10	24	39	42	37.5	10.2	54	540	11.5	12.8	5.2	4.7	90	80	Q90106JA**
12	24	39	42	37.5	10.2	54	648	12.1	13.5	4.7	4.2	90	80	Q90126JA**
15	28	43	42	37.5	10.2	54	810	14.1	15.7	4.0	3.6	90	80	Q90156JA**
18	30	45	42	37.5	20.3	54	972	15.6	17.3	3.5	3.2	90	80	Q90186JA**
20	30	45	42	37.5	20.3	54	1080	16.4	18.2	3.3	3.0	90	80	Q90206JA**
22	30	51	42	37.5	20.3	54	1188	17.1	19.0	3.2	2.9	90	80	Q90226JA**
25	30	45	57	52.5	20.3	35	875	-	16.9	-	4.1	-	140	T90256JA**
30	35	50	57	52.5	20.3	35	1050	-	19.9	-	3.5	-	140	T90306JA**
35	35	50	57	52.5	20.3	35	1225	-	21.1	-	3.1	-	140	T90356JA**
40	40	53	57	52.5	20.3	35	1400	-	23.5	-	2.8	-	140	T90406JA**
45	40	53	57	52.5	20.3	35	1575	-	24.5	-	2.5	-	160	T90456JA**
50	45	55	57	52.5	20.3	35	1750	-	26.9	-	2.3	-	160	T90506JA**
55	45	65	57	52.5	20.3	35	1925	-	29.6	-	2.1	-	160	T90556JA**
60	45	65	57	52.5	20.3	35	2100	-	30.8	-	2.0	-	160	T90606JA**

(1) Maximum RMS current at +70°C, 10KHz, $\Delta T = +15^\circ C$ (Hot spot temp. = $T_{amb} + \Delta T = 70^\circ C + 15^\circ C = 85^\circ C$)

(2) Typical ESR values at 10KHz, 20°C
(Maximum ESR value : less than 2.5 x typical ESR value)

(3) Maximum TanD value at 10KHz, 20°C

Capacitance	TanD ($\times 10^{-4}$) at 1KHz
P=27.5mm	≤ 10
C \leq 30 μF	≤ 15
C > 30 μF	≤ 20
C \geq 100 μF	≤ 30

Metallized Polypropylene Film Capacitors (DC-link application)

$V_{Rdc} = 1100Vdc$ at 85°C (1300Vdc at 70°C)

CAP. (uF)	Dimension (mm)			P (mm)	P1 (mm)	dv/dt (V/us)	Ipk (A)	I _{rms} ⁽¹⁾ (A)		ESR ⁽²⁾ (mΩ)		TanD ⁽³⁾ (x10 ⁻⁴)		Part No. P246
	b	h	l					2P	4P	2P	4P	2P	4P	
1	11	21	31	27.5	-	100	100	3.8		19.1		40	-	L11105JA**
1.5	13	23	31	27.5	-	100	150	4.9		13.2		40	-	L11155JA**
2	15	25	31	27.5	-	100	200	6.0		10.0		40	-	L11205JA**
3	18	28	31	27.5	-	100	300	7.6		7.4		40	-	L11305JA**
4	21	31	31	27.5	-	100	400	9.1		6.0		40	-	L11405JA**
5	22	37	31	27.5	10.2-	100	500	10.3	10.8	5.4	4.9	40	35	L11505JA**
5	18	33	42	37.5	-	73	365	9.2	-	7.0	-	70	-	Q11505JA**
6	20	35	42	37.5	10.2	73	438	9.4	10.5	6.6	6.0	70	60	Q11605JA**
8	24	39	42	37.5	10.2	73	584	11.4	12.6	5.3	4.8	70	60	Q11805JA**
10	28	43	42	37.5	10.2	73	730	13.6	15.1	4.4	4.0	70	60	Q11106JA**
12	28	43	42	37.5	10.2	73	876	14.5	16.1	3.9	3.5	70	60	Q11126JA**
15	30	51	42	37.5	20.3	73	1095	17.2	19.1	3.2	2.9	70	60	Q11156JA**
15	30	45	57	52.5	20.3	50	750	-	14.1	-	5.9	-	120	T11156JA**
20	30	45	57	52.5	20.3	50	1000	-	17.2	-	4.6	-	120	T11206JA**
25	35	50	57	52.5	20.3	50	1250	-	18.9	-	3.8	-	120	T11256JA**
30	40	53	57	52.5	20.3	50	1500	-	21.4	-	3.4	-	140	T11306JA**
35	45	55	57	52.5	20.3	50	1750	-	23.8	-	3.0	-	140	T11356JA**
40	45	65	57	52.5	20.3	50	2000	-	26.5	-	2.7	-	140	T11406JA**
45	45	65	57	52.5	20.3	50	2250	-	27.8	-	2.5	-	140	T11456JA**

(1) Maximum RMS current at +70°C, 10KHz, $\Delta T = +15^\circ C$ (Hot spot temp. = $T_{amb} + \Delta T = 70^\circ C + 15^\circ C = 85^\circ C$)

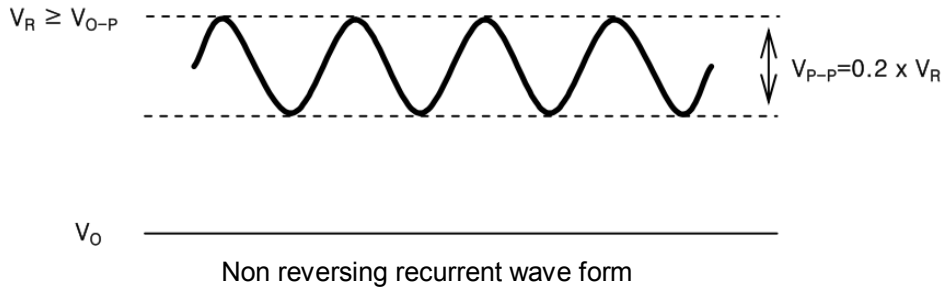
(2) Typical ESR values at 10KHz, 20°C
(Maximum ESR value : less than 2.5 x typical ESR value)

(3) Maximum TanD value at 10KHz, 20°C

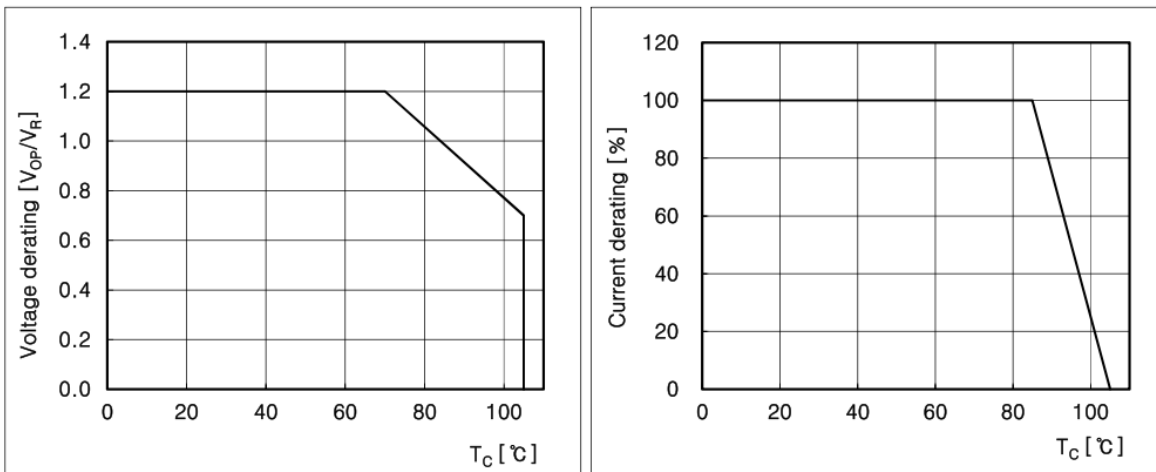
Capacitance	TanD (x 10 ⁻⁴) at 1KHz
P=27.5mm	≤ 10
C ≤ 30uF	≤ 15
C > 30uF	≤ 20
C ≥ 100uF	≤ 30

PERMISSIBLE VOLTAGE

- These capacitors are designed only for DC voltage. So should not be used for AC line.
- Use the peak voltage(V_{O-P}) within the rated voltage.
- Use the peak to peak ripple voltage(V_{P-P}) within $0.2 \times V_R$



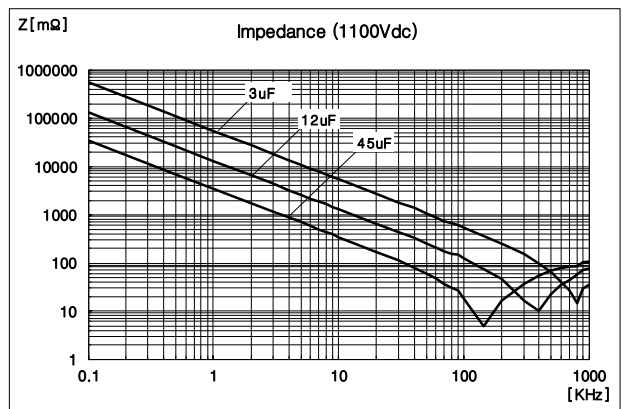
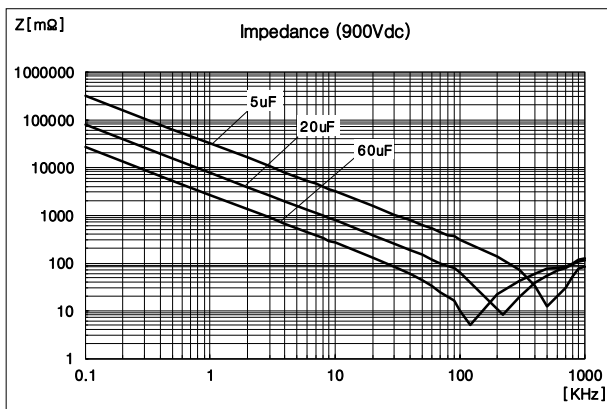
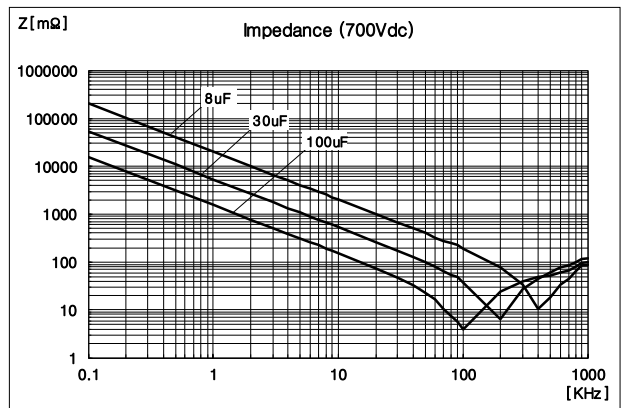
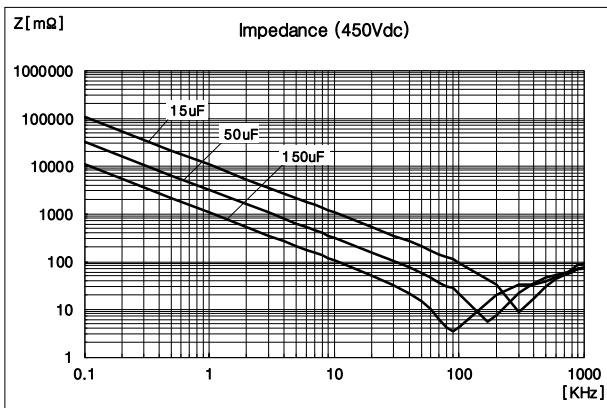
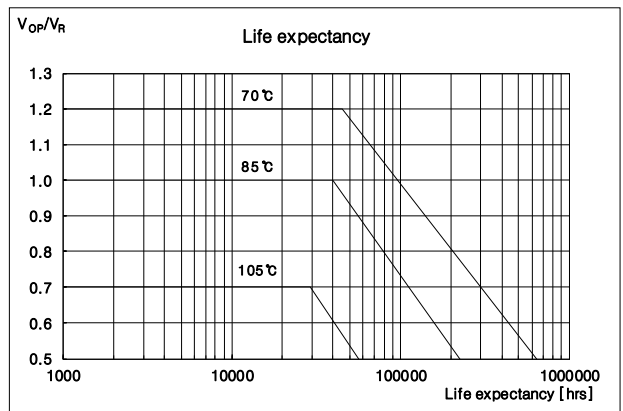
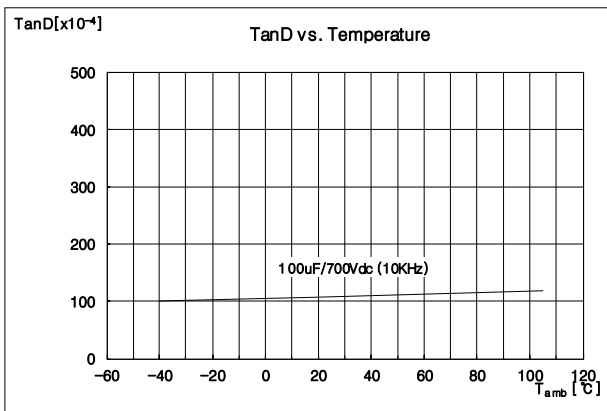
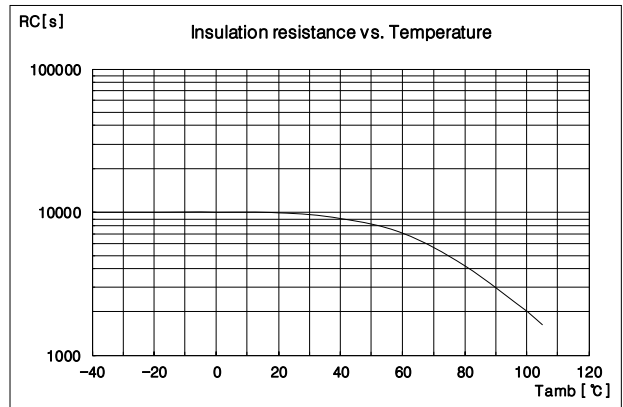
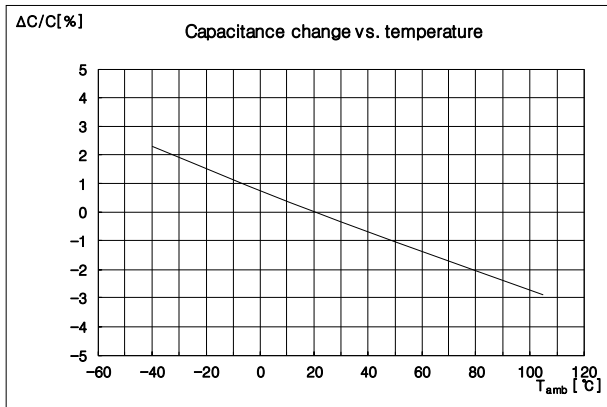
DC VOLTAGE & PEAK CURRENT & RMS CURRENT DERATING



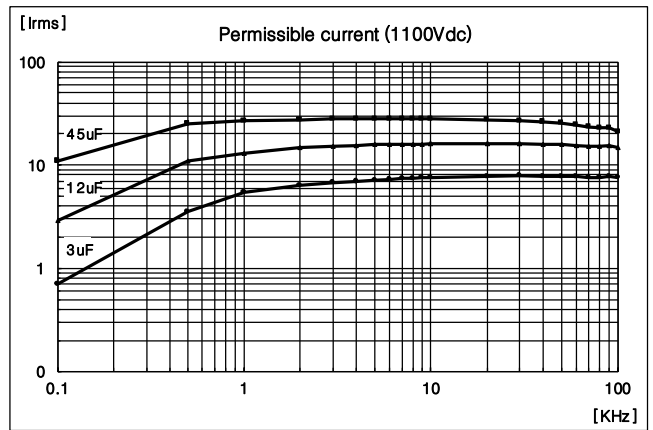
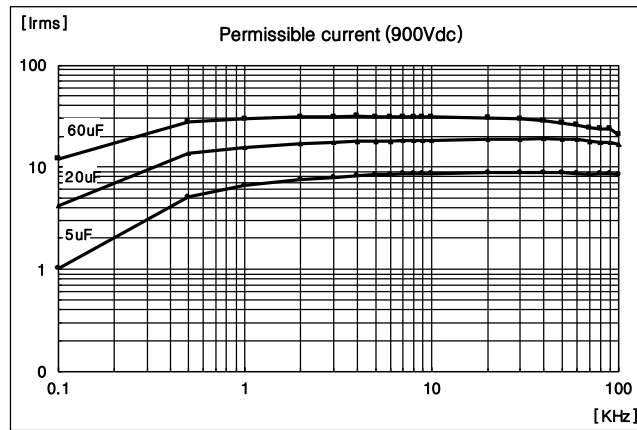
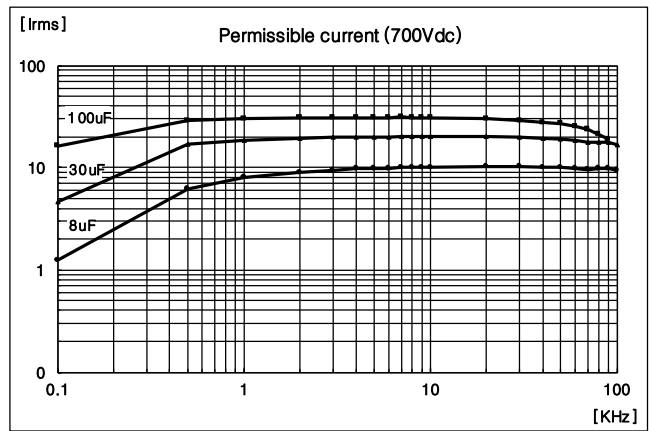
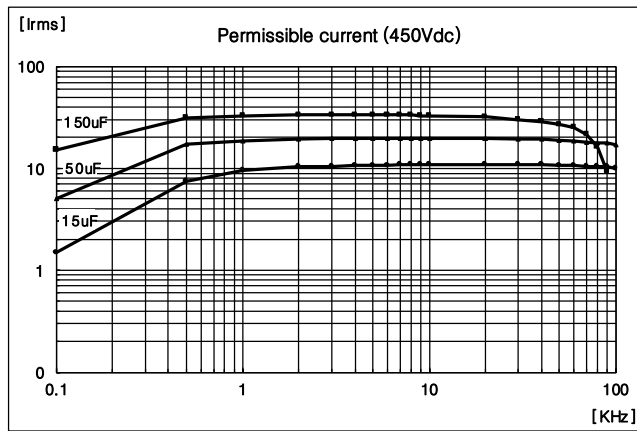
MAXIMUM REPETITIVE PEAK VOLTAGE

Repetitive surge voltage	Maximum duration / day
$1.1 \times V_{Rdc}$	30% of on load duration
$1.15 \times V_{Rdc}$	30min
$1.2 \times V_{Rdc}$	5min
$1.3 \times V_{Rdc}$	1min
$1.5 \times V_{Rdc}$	110ms

CHARACTERISTICS



PERMISSIBLE CURRENT



PRODUCT MARKING

Capacitors are marked on the top with the following information :

- . Rated capacitance code in accordance with IEC 60062
- . Tolerance on rated capacitance : J : $\pm 5\%$ K : $\pm 10\%$
- . Rated (DC) Voltage (450 V)
- . Manufacturer's type designation (PCPW 246)
- . Code for dielectric material (MKP)
- . Manufacturer's name (PILKOR)
- . Year and week code (WK1720)
- . Marking color : white

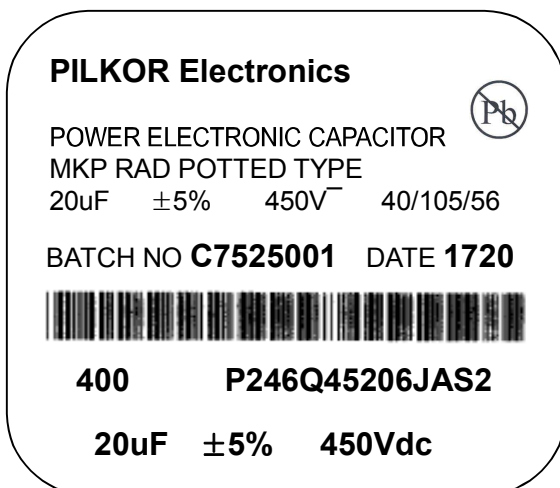
Example of marking

20u	J	450V	PILKOR
PCPW 246	MKP	WK1720	

Marking on the top

PACKAGE MARKING

The package containing the capacitors is marked as shown.



LINE MARKING EXPLANATION

- 1 Manufacturer's name
- 2 Sub – family
3. Pb free marking(JEDEC-STD-97)
- 4 Type description
- 5 Capacitance value, tolerance,
Voltage and climatic category (IEC)
- 6 Batch no. & production period
year and week code
- 7 Quantity and Product code (13NC)
- 8 Capacitance, tolerance and voltage

Metallized Polypropylene Film Capacitors (DC-link application)

TEST REQUIREMENTS

NO	ITEM	TEST CONDITIONS	REQUIREMENTS																		
1	Capacitance	1KHz at room temperature	Shall be with in prescribed tolerance range																		
2	TanD	10KHz at room temperature	With in specified limit																		
3	Insulation Resistance	at 100V, 1min for $V_{Rdc} < 500V$ at 500V, 1min for $V_{Rdc} \geq 500V$	RC ($\Omega \cdot F$) > 10,000 s																		
4	Voltage test between terminal	terminal-terminal : $1.5 \times V_{Rdc}$, 10s terminal-case : $2,000V_{AC}$, 60s	No visible damage or puncture No flashover																		
5	Surge discharge	$1.3 \times V_{Rdc}$ ($1.3 \times I_{pk}$) Number of discharge : 1000 Time lapse : within 2min (total 33.3hrs)	Cap. loss < 2% at 1KHz $\Delta TanD < 1.2 \times \text{initial TanD} + 0.0001$ at 10KHz IR < 50% of specified limit																		
6	Rapid change of temperature	$-40 \pm 2^\circ C$ = lower category temp. $+105 \pm 2^\circ C$ = upper category temp. Transition time = 1h 5 cycles	Visual : No abnormality Cap. loss < 2% at 1KHz $\Delta TanD < 0.0150$ at 10KHz IR < 50% of specified limit																		
7	Damp heat load	$40 \pm 2^\circ C$, 93 \pm 3%RH, V_R , 1000hrs	Cap. loss < 10% at 1KHz $\Delta TanD < 0.0150$ at 10KHz IR < 50% of specified limit																		
8	Endurance	$85 \pm 2^\circ C$: $1.3 \times V_{Rdc}$, 1000hrs $105 \pm 2^\circ C$: $1.3 \times V_{OPdc}$, 1000hrs	Cap. loss < 5% at 1KHz $\Delta TanD < 0.0150$ at 10KHz IR < 50% of specified limit																		
9	Robustness of termination	1) Lead pull test <table border="1"> <thead> <tr> <th>Wire dia.</th> <th>Load</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>$\leq 0.8mm$</td> <td>10N</td> <td>10 \pm 1 s</td> </tr> <tr> <td>$> 0.8mm$</td> <td>20N</td> <td>10 \pm 1 s</td> </tr> </tbody> </table> 2) Lead bend test(2cycle) <table border="1"> <thead> <tr> <th>Wire dia.</th> <th>Load</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>$\leq 0.8mm$</td> <td>10N</td> <td>2~3 s/bend</td> </tr> <tr> <td>$> 0.8mm$</td> <td>20N</td> <td>2~3 s/bend</td> </tr> </tbody> </table>	Wire dia.	Load	Time	$\leq 0.8mm$	10N	10 \pm 1 s	$> 0.8mm$	20N	10 \pm 1 s	Wire dia.	Load	Time	$\leq 0.8mm$	10N	2~3 s/bend	$> 0.8mm$	20N	2~3 s/bend	2) No abnormality such as cutting, slack of termination
Wire dia.	Load	Time																			
$\leq 0.8mm$	10N	10 \pm 1 s																			
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Wire dia.	Load	Time																			
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$> 0.8mm$	20N	2~3 s/bend																			
10	Solderability	Non-activated colophony flux 501 Solder bath temp. : $245 \pm 5^\circ C$ Immerse time : $2 \pm 0.5s$	Good tinning as evidenced by free flowing of the solder with wetting of the terminations (>95%)																		
11	Resistance to soldering heat	No pre-drying Solder bath temp. : $260 \pm 5^\circ C$ Dipping time : $10 \pm 1s$	Visual : No abnormality Cap. loss < 2% at 1KHz $\Delta TanD < 0.0050$ at 10KHz IR < 50% of specified limit																		
12	Vibration	10Hz to 55Hz ; Amplitude $\pm 0.35mm$ or acceleration 98m/s ² Test duration : 10 frequency cycles 3 axes offset from each other by 90° 1octave/min	No visible damage Cap. loss < 2% at 1KHz $\Delta TanD < 0.0050$ at 10KHz IR < 50% of specified limit																		
13	Shock or impact	Pulse shape : half sine Acceleration : 490 m/s ² Duration of pulse : 11 ms	No visible damage Cap. loss < 2% at 1KHz $\Delta TanD < 0.0050$ at 10KHz IR < 50% of specified limit																		