A KYOCERA GROUP COMPANY

TPC
FFB RANGE
Capacitors for medium power electronics

Version 05th April 00

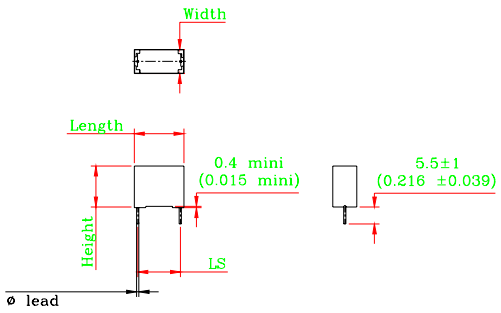
The FFB series uses a non-impregnated metallized polypropylene or Polyester dielectric with the controlled self healing process, specially treated to have a very high dielectric strength in operating conditions up to 100 °C.
The FFB has been designed for printed circuit board mounting.
Furthermore their performances allow to be a very interesting alternative to electrolytic technology because they can withstand much higher levels of surge voltage.

Usual Applications

The FFB capacitor are particularly designed for DC filtering, low reactive power.

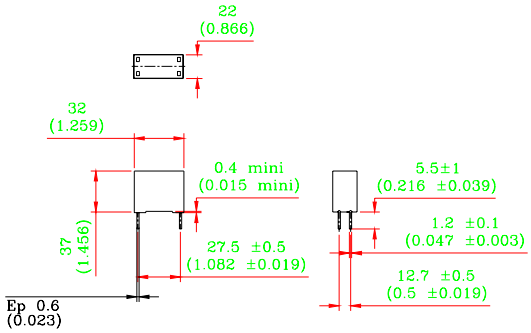
Presentation

BOX KIND : P0; 18; 19; 26; R68
2 TERMINALS SOLUTION



General tolerances : ±0.5mm (0.020)

BOX KIND : R 68
4 TERMINALS SOLUTION



General tolerances : ±0.5mm (0.020)

Box kind	Length mm ±0.4 (inches)	Width mm ±0.4 (inches)	Height mm ±0.3 (inches)	Dimensions lead mm (inches)	LS mm ±0.4 (inches)
PO	31.1 (1.23)	13 (0.51)	22.4 (0.88)	Diameter : 0.8 (0.031)	27.5 (1.083)
18	31.1 (1.23)	14.6 (0.58)	25.7 (1.01)	Diameter : 0.8 (0.031)	27.5 (1.083)
19	31.1 (1.23)	17.3 (0.68)	29.8 (1.17)	Diameter : 0.8 (0.031)	27.5 (1.083)
26	31.1 (1.23)	20.8 (0.82)	31.3 (1.23)	Diameter : 1 (0.039)	27.5 (1.083)
R68 2 TERMINALS SOLUTION	32 (1.26)	22 (0.87)	37 (1.46)	Diameter : 1 (0.039)	27.5 (1.083)
R68 4 TERMINALS SOLUTION	32 (1.26)	22 (0.87)	37 (1.46)	1.2 X 0.6 (0.047 X 0.024)	27.5 (1.083)

General characteristics

Climatic category :

55/100/56 (IEC68)

Test voltage between terminals

@ 25°C: 1.5 x $U_N$dc

Standards

IEC 1071-1 IEC 1071-2 : Power electronic capacitors.
IEC 60 384 -16 : fixed metallized polypropylene film dielectric dc capacitors.
IEC 60 384 –16 -1 : fixed metallized polypropylene film dielectric dc capacitors. Assessment level E.
IEC 60 384 -17 : fixed metallized polypropylene film dielectric ac and pulse capacitors.
IEC 60 384 -17 -1 : fixed metallized polypropylene film dielectric ac and pulse capacitors. Assessment level E.

Working temperature

(according to the power to be dissipated) -55°C +100°C.

Life time expectancy

One unique feature of this technology (as opposed to electolytics) is how the capacitor reacts at the end of its lifetime. Whereas with an electrolytic there is a strong risk of explosion of the case. However with our line of film capacitors, the capacitor will simply experience at the end of life a loss of capacitance of about 5%, with no risk of explosion.
Please note that this is theoretical, however, as the capacitor continues to be functional even after this 5% decrease.

DC Filtering for low voltage

Electrical characteristics

Capacitance range C_N	**6,2 µF to 110 µF**
Tolerance on C_N	**± 10 %**
Rated dc voltage U_N dc	**75 V to 400 V**
Dielectric	**polyester**

Hot spot temperature calculation

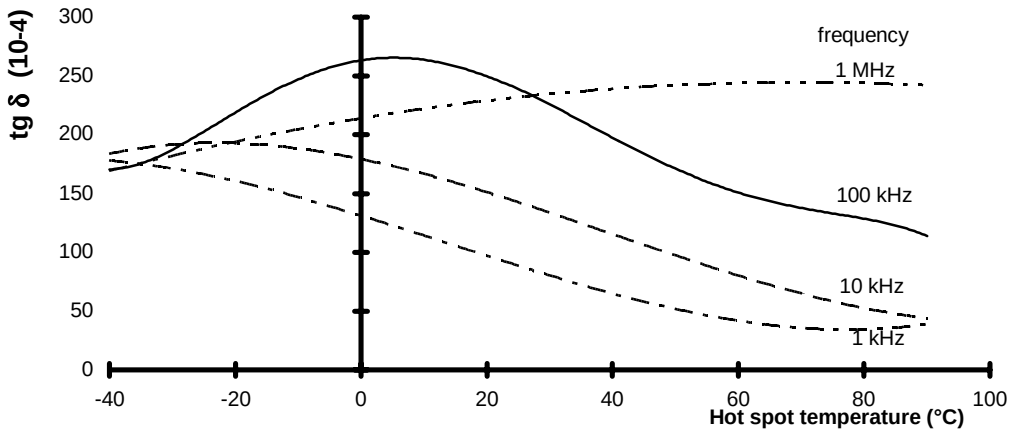
You can calculate the maximum operating (hot spot) temperature of this capacitor in the following manner:
The loss factor of the capacitor is made up of the sum of two components. The first represents electrical losses in the polyester dielectric and the second component represents Joule effect in the connection and foils (R_S.C.2 f).
For all applications, the temperature in the hot spot capacitor must be lower than 100°C.

$$\theta \text{ hot spot} = \theta \text{ ambient} + (\text{tg } \delta.Q + Rs.Irms^2) \times Rth$$

With :

Q : Reactive power in var
R_S in Ohm
I_{rms} in A
R_{th} : Rth ambient / hot spot in °C/W
tg δ.(10^{-4}) is the tangent of loss angle for polyester dielectric. Dielectric losses factor of polyester are function of temperature and frequency.(See the curves below).

tangent δ in Polyester Dielectric vs. hot spot temperature



DC Filtering for low voltage

POLYESTER DIELECTRIC

Value tables

U_N dc : 75 volts Urms max.: 45 volts

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
33	PO	3	3	40.7	FFB14D0336K- -
47	18	4.3	2	33.3	FFB24D0476K- -
68	19	6.2	1.7	29.9	FFB34D0686K- -
82	26	7.4	1.6	26.7	FFB44D0826K- -
110	R68 (2terminals)	10	1.4	22.9	FFB54D0116K- -
110	R68 (4terminals)	10	1.4	22.9	FFB54D0116KJC

U_N dc : 100 volts Urms max.: 60 volts

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
20	PO	2.6	3	40.5	FFB14E0206K- -
27	18	3.5	2.5	33.3	FFB24E0276K- -
39	19	5	2	29.8	FFB34E0396K- -
47	26	6	1.7	26.6	FFB44E0476K- -
68	R68 (2terminals)	9	1.4	22.8	FFB54E0686K- -
68	R68 (4terminals)	9	1.4	22.8	FFB54E0686KJC

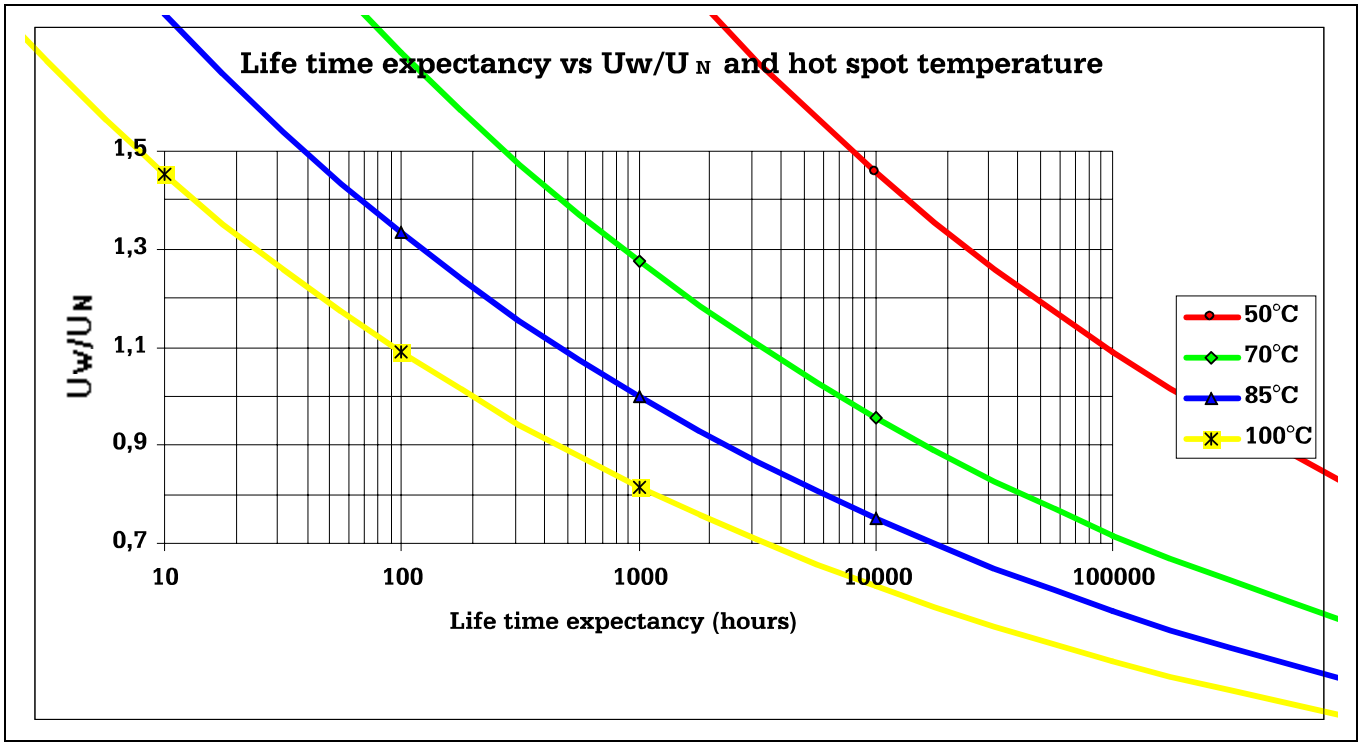
U_N dc : 300 volts Urms max.: 90 volts

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
7.5	PO	2.4	16	40.7	FFB14H0755K- -
11	18	3.6	11	33.5	FFB24H0116K- -
16	19	5.2	8	29.9	FFB34H0166K- -
18	26	6	7	27.1	FFB44H0186K- -
27	R68 (2terminals)	9	5	22.9	FFB54H0276K- -
27	R68 (4terminals)	9	5	22.9	FFB54H0276KJC

U_N dc : 400 volts Urms max.: 105 volts

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
6.2	PO	2.5	17	40.5	FFB14I0625K- -
7.5	18	3.1	14	33.5	FFB24I0755K- -
12	19	5	9	29.9	FFB34I0126K- -
15	26	6.2	7	26.4	FFB44I0156K- -
20	R68 (2terminals)	8.2	5.5	22.8	FFB54I0206K- -
20	R68 (4terminals)	8.2	5.5	22.8	FFB54I0206KJC

DC Filtering for low voltage



Uw : Working dc voltage

Un : Rated dc voltage

DC Filtering for Industrial application

These capacitors have been designed principally for high and medium power DC Filtering applications.

Electrical characteristics

Capacitance range C_N	1,5 µF to 13 µF
Tolerance on C_N	± 10 %
Rated dc voltage U_N dc	525 V to 1100 V
Dielectric	Polypropylene

Tangent of loss angle (tan δ_0) for polypropylene dielectric.

Polypropylene has a constant dielectric losses factor of 2.10^{-4} irrespective of temperature and frequency (up to 1 MHz).

Hot spot temperature calculation

You can calculate the maximum operating (hot spot) temperature of this capacitor in the following manner:
The loss factor of the capacitor is made up of the sum of two components. The first represents electrical losses (tg $\delta = 2.10^{-4}$) and the second component represents Joule effect in the connection and foils (R_S.C.2 f).
For all applications, the temperature in the hot spot capacitor must be lower than 100˚C.
Heating calculation of hot spot capacitor :

$$\theta \text{ hot spot} = \theta \text{ ambient} + (\text{tg } \delta.Q + Rs.Irms^2) \times Rth$$

With :

Q : Reactive power in var
R_S in Ohm
I_{rms} in A
R_{th} : Rth ambient / hot spot in ˚C/W
tg $\delta.(10^{-4})$ is the tangent of loss angle for polypropylene dielectric. Polypropylene has a constant dielectric losses factor of 2.10^{-4} irrespective of temperature and frequency (up to 1MHz).

DC Filtering for Industrial application

POLYPROPYLENE DIELECTRIC

Value tables

U_N dc : 525 volts **Urms max. : 105 volts**

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
3.9	PO	5.1	30	45.7	FFB16J0395K- -
5.6	18	7.4	21	36.4	FFB26J0565K- -
8.2	19	10.9	15	32.6	FFB36J0825K- -
10	26	13.3	12	29.8	FFB46J0106K- -
13	R68 (2terminals)	16.7	9	24.3	FFB56J0136K- -
13	R68 (4terminals)	16.7	9	24.3	FFB56J0136KJC

U_N dc : 720 volts **Urms max.: 120 volts**

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
3.3	PO	5.0	31	45.0	FFB16A0335K- -
4.3	18	6.5	24	36.2	FFB26A0435K- -
6.2	19	9.4	17	32.7	FFB36A0625K- -
7.5	26	11.4	14	29.9	FFB46A0755K- -
10	R68 (2terminals)	15.2	11	24.2	FFB56A0106K- -
10	R68 (4terminals)	15.2	11	24.2	FFB56A0106KJC

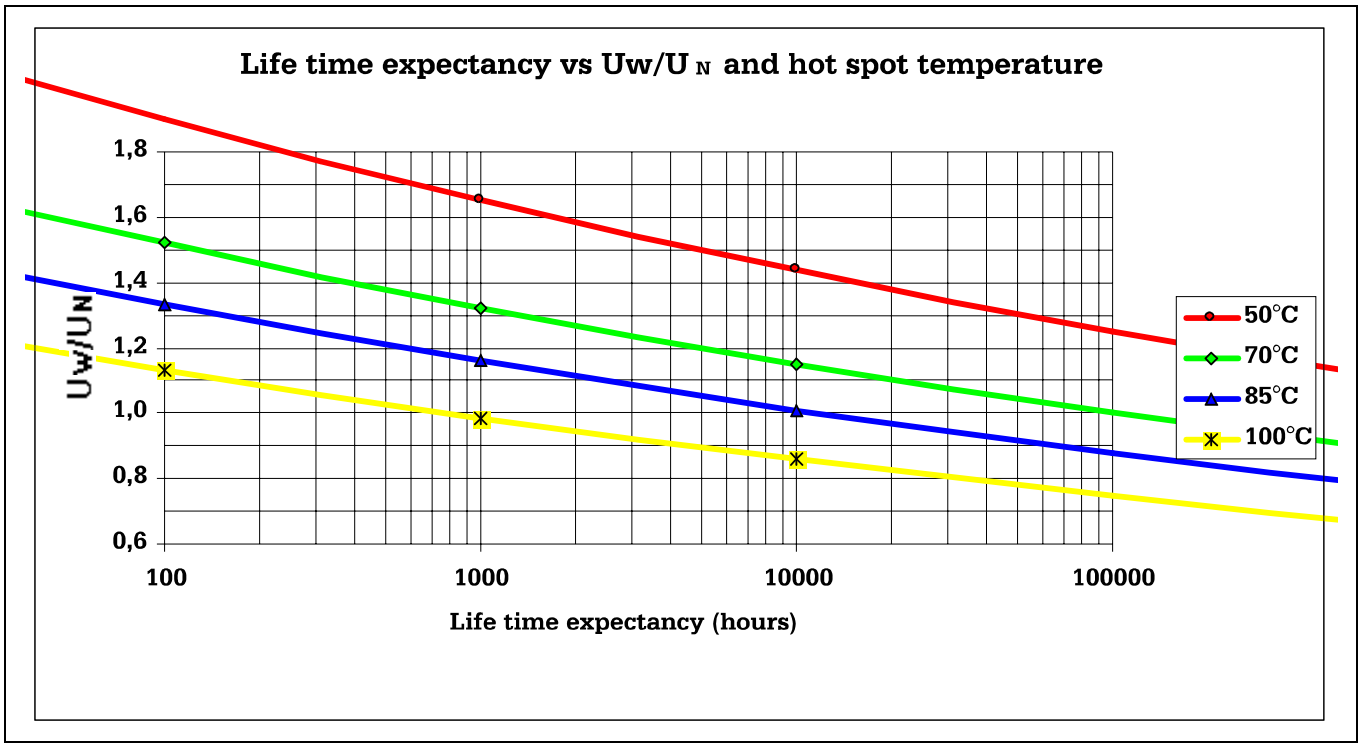
U_N dc : 900 volts **Urms max.: 150 volts**

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
2	PO	3.6	41	45.7	FFB16C0205K- -
2.7	18	4.9	30	36.6	FFB26C0275K- -
3.9	19	7.2	21	32.9	FFB36C0395K- -
5.1	26	9.3	16	29.7	FFB46C0515K- -
6.8	R68 (2terminals)	12.5	12	24.1	FFB56C0685K- -
6.8	R68 (4terminals)	12.5	12	24.1	FFB56C0685KJC

U_N dc : 1100 volts **Urms max.: 180 volts**

Capacitance (µF)	Box kind	I_{rms} max. (A)	R_S (m)	R_{th} (°C/W)	Part number
1.5	PO	3.3	45	45.2	FFB16L0155K- -
1.8	18	3.9	40	36.5	FFB26L0185K- -
2.4	19	5.3	28	33.4	FFB36L0245K- -
3	26	6.6	23	30.2	FFB46L0305K- -
4.7	R68 (2terminals)	10.3	15	24.1	FFB56L0475K- -
4.7	R68 (4terminals)	10.3	15	24.1	FFB56L0475KJC

DC Filtering for Industrial application



Uw : Working dc voltage

Un : Rated dc voltage