

max.+105°C,for general purpose,metallized polyester,tape wrapped,axial capacitor

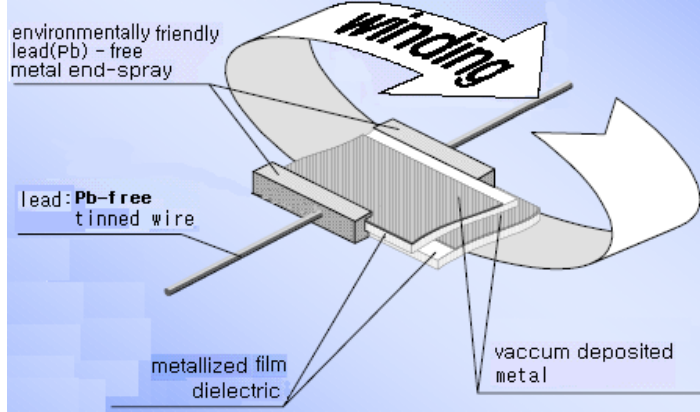
[1]Features

- Self-heals.
- Pb(lead)-free product.
- RoHS Compliant product.

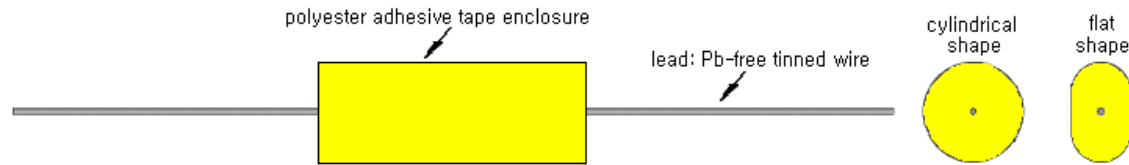
[2]Typical applications

For general purpose;blocking,coupling,decoupling,by-pass,discharge,energy storage on low frequency & low pulse but larger current, high frequency & high pulse operation.

[3]Construction



RoHS Compliant



①Style :axial.

②Winding :non-inductively wound self-healing metallized polyester film(vacuum deposited aluminum on polyester film), wrapped with polyester adhesive tape,ends sealed with flame retardant epoxy resin (UL94V-O) fill.

③Termination :central axial,Pb-free tinned leads.

[4]Specifications

①General data

Applicable standard	IEC60384-2,JIS C5115		
Rated voltage(URDC)	100VDC,250VDC,400VDC,630VDC,1000VDC.		
Capacitance range	0.001uF~47uF		
Capacitance tolerance	±5%(J),±10%(K) at 20°C,1Khz		
Operating temperature range (TR:+85°C,Tmax.:+105°C)	-40~+105°C *+85°C~+105°C:Derate the rated voltage as shown in the below fig. (70% of the rated voltage at +105°C)		

②Electrical data

Withstand voltage	1.6URDC for 2sec.at 20°C,between leads(1.6URDC for 1 min. for type test)		
Dissipation factor(DF)at 20°C,1Khz	1.0% max.		
Insulation resistance(Rins) at 20°C,between leads	CR ≤ 0.33uF ≥ 9,000MΩ	CR > 0.33uF ≥ 3,000s	applied for 1 min.100VDC: for URDC < 500V 500VDC: for URDC ≥ 500V

*CR = Nominal Capacitance in μF

③Environmental test data

	Test conditions	Test criteria
Damp heat test	40±2°C,R.H.:90~95% applying URDC for 500+24/0 hours	①Rins(between leads):≥ 0.5 x specified value in ②Electrical data ②DF:≤ 1.1% ③ $\frac{C}{C_0} \leq \pm 5\%$ of initial value
Endurance test	85±2°C,applying 1.25URDC for 1,000+48/0 hours	①Rins(between leads):≥ 0.5 x specified value in ②Electrical data ②DF:≤ 1.2% ③ $\frac{C}{C_0} \leq \pm 7\%$ of initial value

[5]Marking

URDC,Capacitance & tolerance are marked on the capacitor.

[6]Ordering/part number information

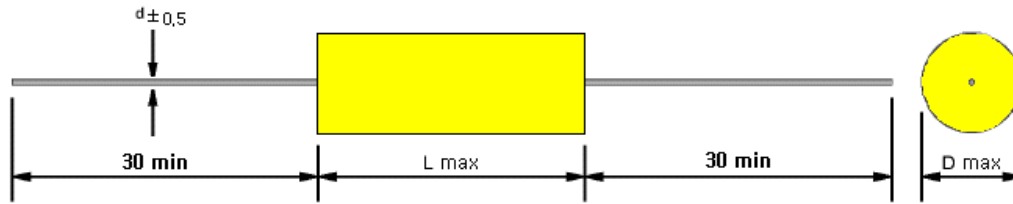
CF	91	M	F	-	2E	104	K		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

- (1)Kind of capacitor:metallized plastic film capacitor
- (2)Shape of capacitor:non-inductive wound,axial tape wrapped.
05:cylindrical shape
91:flat shape
- (3)Dielectrics:polyester
- (4)Operating temperature:-40°C~+105°C
- (5)internal use
- (6)*DC rated voltage code:250VDC
- (7)*Rated capacitance in pF:100,000pF=0.1uF
- (8)*Capacitance tolerance code:±10%
- (9)(10)No code for straight long leads,bulk,loose parts in a poly.bag

*For further details,refer to [\[Part numbering system & taping specification\]](#)

[7]Dimensions in mm

①Cylindrical shape:CF05MF series



URDC:100V

uF	L	D	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.068	11.0	5.0	0.6	5.0v/ μ s
0.1	11.0	5.0	0.6	
0.15	11.0	5.0	0.6	
0.22	11.0	5.0	0.6	
0.33	11.0	6.0	0.6	
0.47	11.0	7.0	0.6	
0.68	14.0	6.0	0.6	
1.0	14.0	7.0	0.6	3.0v/ μ s
1.5	14.0	9.0	0.6	
2.2	20.5	8.0	0.8	
3.3	20.5	10.0	0.8	2.0v/ μ s
4.7	20.5	12.0	0.8	
6.8	28.0	11.0	0.8	1.0v/ μ s
10.0	28.0	14.0	0.8	
15.0	33.0	15.0	0.8	
22.0	33.0	18.0	0.8	
33.0	33.0	21.0	0.8	
47.0	33.0	25.0	0.8	

URDC:250V

uF	L	D	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.01	11.0	5.0	0.6	10.0v/ μ s
0.015	11.0	5.0	0.6	
0.022	11.0	5.0	0.6	
0.033	11.0	5.0	0.6	
0.047	11.0	5.0	0.6	
0.068	11.0	5.0	0.6	
0.1	11.0	6.0	0.6	
0.15	11.0	7.0	0.6	
0.22	14.0	6.0	0.6	
0.33	14.0	7.0	0.6	
0.47	14.0	9.0	0.6	7.0v/ μ s
0.68	20.5	8.0	0.8	
1.0	20.5	9.0	0.8	
1.5	20.5	11.0	0.8	4.0v/ μ s
2.2	20.5	13.0	0.8	
3.3	28.0	13.0	0.8	2.5v/ μ s
4.7	28.0	15.0	0.8	
6.8	33.0	16.0	0.8	
10.0	33.0	19.0	0.8	
15.0	33.0	23.0	0.8	

URDC:400V

uF	L	D	d	permissible $\frac{dv}{dt}$ value ($\leq 10,000$ pulses)
0.01	11.0	5.0	0.6	13.5v/ μ s
0.015	11.0	5.0	0.6	
0.022	11.0	5.0	0.6	
0.033	11.0	5.0	0.6	
0.047	11.0	6.0	0.6	
0.068	11.0	7.0	0.6	
0.1	14.0	6.0	0.6	
0.15	14.0	7.0	0.6	
0.22	14.0	9.0	0.6	
0.33	20.5	8.0	0.8	
0.47	20.5	9.5	0.8	
0.68	20.5	11.5	0.8	
1.0	20.5	13.0	0.8	6.5v/ μ s
1.5	28.0	12.5	0.8	
2.2	28.0	15.0	0.8	
3.3	33.0	16.0	0.8	4.0v/ μ s
4.7	33.0	19.5	0.8	
6.8	33.0	23.5	0.8	

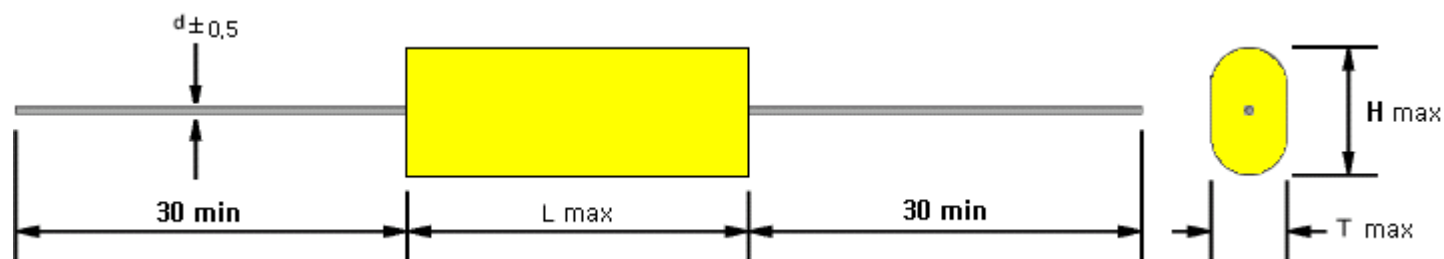
URDC:630V

uF	L	D	d	permissible $\frac{dv}{dt}$ value ($\leq 10,000$ pulses)
0.0010	11.0	5.0	0.6	20.0v/ μ s
0.0015	11.0	5.0	0.6	
0.0022	11.0	5.0	0.6	
0.0033	11.0	5.0	0.6	
0.0047	11.0	5.0	0.6	
0.0068	11.0	5.0	0.6	
0.01	11.0	5.0	0.6	
0.015	11.0	6.0	0.6	
0.022	14.0	6.0	0.6	
0.033	14.0	6.5	0.6	
0.047	14.0	7.0	0.6	
0.068	14.0	9.0	0.6	
0.1	20.5	7.5	0.8	15.0v/ μ s
0.15	20.5	9.0	0.8	
0.22	20.5	11.0	0.8	
0.33	28.0	10.5	0.8	10.0v/ μ s
0.47	28.0	12.0	0.8	
0.68	28.0	15.0	0.8	
1.0	33.0	16.0	0.8	6.0v/ μ s
1.5	33.0	19.0	0.8	
2.2	33.0	23.0	0.8	

URDC:1000V

uF	L	D	d	permissible $\frac{dv}{dt}$ value ($\leq 10,000$ pulses)
0.0010	11.0	5.0	0.6	50.0v/ μ s
0.0015	11.0	5.0	0.6	
0.0022	11.0	5.0	0.6	
0.0033	11.0	5.0	0.6	
0.0047	11.0	5.5	0.6	
0.0068	11.0	6.5	0.6	
0.01	14.0	5.5	0.6	
0.015	14.0	6.5	0.6	
0.022	14.0	7.0	0.6	
0.033	14.0	8.5	0.6	
0.047	20.5	7.5	0.8	30.0v/ μ s
0.068	20.5	9.0	0.8	
0.1	20.5	11.0	0.8	
0.15	28.0	10.0	0.8	15.0v/ μ s
0.22	28.0	12.0	0.8	
0.33	28.0	15.0	0.8	
0.47	33.0	15.0	0.8	10.0v/ μ s
0.68	33.0	19.0	0.8	
1.0	33.0	22.0	0.8	

Flat shape:CF91MF series



URDC:100V

uF	L	H	T	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.1	14.0	8.0	4.5	0.6	5.0v/ μ s
0.15	14.0	8.0	4.5	0.6	
0.22	14.0	8.5	5.0	0.6	
0.33	14.0	8.5	5.5	0.6	
0.47	20.5	9.0	5.0	0.8	3.0v/ μ s
0.68	20.5	9.5	5.0	0.8	
1.0	20.5	10.0	6.0	0.8	
1.5	20.5	11.0	6.5	0.8	2.0v/ μ s
2.2	28.0	11.0	6.0	0.8	
3.3	28.0	12.0	7.0	0.8	1.0v/ μ s
4.7	33.0	12.5	7.0	0.8	
6.8	33.0	15.0	9.0	0.8	
10.0	33.0	17.0	11.0	0.8	
15.0	33.0	22.0	12.0	0.8	

URDC:400V

uF	L	H	T	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.033	14.0	9.0	5.0	0.6	13.5v/ μ s
0.047	20.5	8.0	4.5	0.8	10.0v/ μ s
0.068	20.5	8.0	5.0	0.8	
0.1	20.5	8.5	5.5	0.8	
0.15	20.5	9.0	5.5	0.8	
0.22	20.5	12.0	7.0	0.8	
0.33	20.5	12.5	7.5	0.8	6.5v/ μ s
0.47	28.0	12.0	7.0	0.8	
0.68	28.0	14.0	8.0	0.8	
1.0	28.0	16.0	9.0	0.8	4.0v/ μ s
1.5	33.0	18.0	11.5	0.8	
2.2	33.0	21.0	14.0	0.8	

URDC:1000V

uF	L	H	T	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.033	20.5	9.5	4.5	0.8	30.0v/ μ s
0.047	20.5	10.5	5.5	0.8	
0.068	28.0	10.0	5.5	0.8	15.0v/ μ s
0.1	28.0	12.0	6.5	0.8	
0.15	33.0	13.0	6.5	0.8	10.0v/ μ s
0.22	33.0	15.0	8.5	0.8	
0.33	33.0	17.5	11.0	0.8	
0.47	33.0	21.0	13.5	0.8	
0.68	33.0	23.0	16.0	0.8	

*Pulse permissible current(Ao-p)=C(μ F) \times permissible $\frac{dv}{dt}$ value(V/ μ s).

If, the operating pulse voltage < the URDC, the max. permissible $\frac{dv}{dt}$ value can be $\frac{URDC}{U_{p-p}} \times$ permissible $\frac{dv}{dt}$ value

URDC:250V

uF	L	H	T	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.068	14.0	8.0	4.5	0.6	10.0v/ μ s
0.1	14.0	8.0	4.5	0.6	
0.15	14.0	9.0	5.0	0.6	
0.22	20.5	9.0	5.0	0.8	7.0v/ μ s
0.33	20.5	9.0	5.0	0.8	
0.47	20.5	10.0	5.5	0.8	
0.68	28.0	10.0	5.5	0.8	4.0v/ μ s
1.0	28.0	11.0	6.5	0.8	
1.5	28.0	12.5	7.5	0.8	
2.2	33.0	14.0	8.5	0.8	2.5v/ μ s
3.3	33.0	16.5	10.0	0.8	
4.7	33.0	19.0	12.0	0.8	
6.8	33.0	22.0	15.0	0.8	

URDC:630V

uF	L	H	T	d	permissible $\frac{dv}{dt}$ value($\leq 10,000$ pulses)
0.01	14.0	9.0	5.0	0.6	20.0v/ μ s
0.015	14.0	9.0	5.0	0.6	
0.022	14.0	11.5	7.5	0.6	
0.033	20.5	7.0	4.5	0.8	15.0v/ μ s
0.047	20.5	8.0	4.5	0.8	
0.068	20.5	9.0	5.0	0.8	
0.1	20.5	11.0	6.0	0.8	10.0v/ μ s
0.15	28.0	11.0	6.5	0.8	
0.22	28.0	13.0	8.0	0.8	
0.33	33.0	14.0	8.0	0.8	6.0v/ μ s
0.47	33.0	16.0	10.0	0.8	
0.68	33.0	19.0	12.0	0.8	
1.0	33.0	21.5	15.0	0.8	

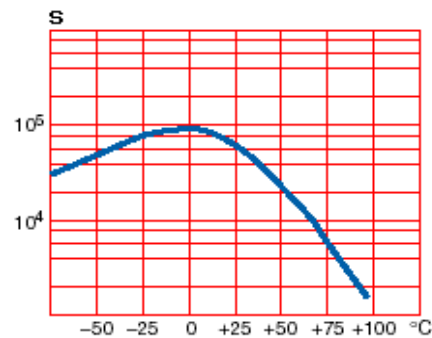
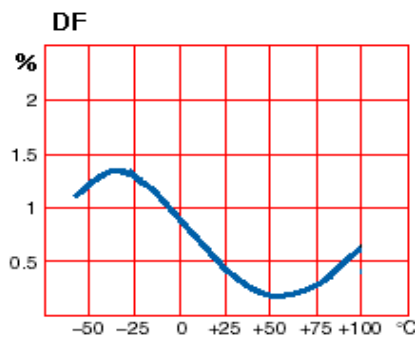
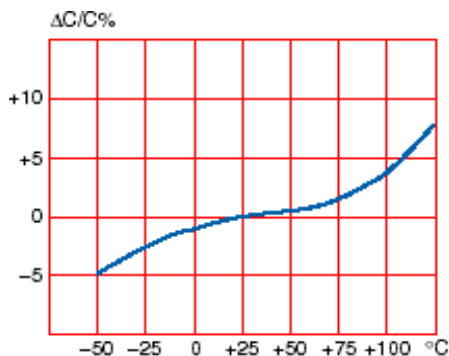
[8] Typical performance characteristics

*slightly different depending on individual ratings

[Capacitance-temperature] at 1kHz

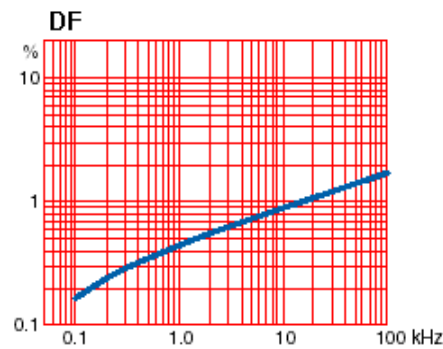
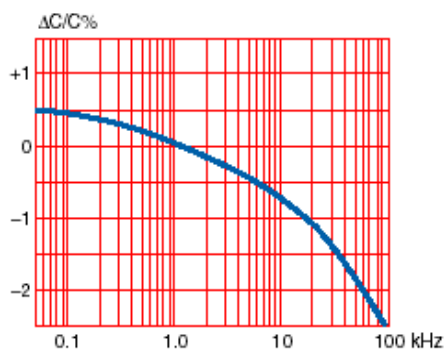
[DF-temperature] at 1kHz

[Rins-Temperature]



[Capacitance-frequency at +20°C]

[DF-frequency at +20°C]



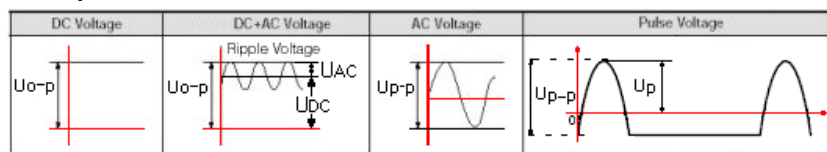
[9] Operating temperature

① In DC circuit : the operating temperature = Ta

② It must be noted, however, that the operating temperature will be the Th (=Ta+ΔT), not the Ta, if ① self-heating(ΔT) or ② surface heating occurs.

[10] Operating voltage(Uo-p)

[Example wave-forms]



① DC voltage application : $U_{o-p} < \text{the URDC}$

② DC+AC voltage(Ripple voltage)application : $U_{o-p}(=U_{DC} + U_{AC}) < \text{URDC}$

③ AC voltage with sine wave form application

① at operating frequency \leq commercial frequency(50/60Hz); the operating AC voltage(Urms) < the URAC specified.

② at operating frequency > commercial frequency; the operating AC voltage(Urms) < the derated AC voltage, which can be determined from the "Max. permissible AC rms voltage(Urms)-frequency" graphs specified.

③ To avoid corona discharge; $U_{p-p} < 2\sqrt{2}URAC$

④ The calculated max. value of Irms($I_p = \sqrt{2}I_{rms}$) < Ao-p.

④ Pulse voltage application (other than a sine wave form)

① The peak value(U_p) < URDC

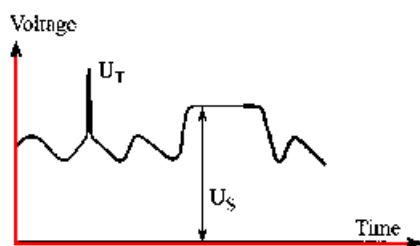
② To avoid corona discharge; U_{p-p} (including noise and transients) < $2\sqrt{2}URAC$.

③ Determined $\frac{dv}{dt}$ value < the permissible $\frac{dv}{dt}$ value specified

④ The ΔT in the actual circuit < max. allowable ΔT specified.

⑤ The operating temperature(Th) < Tmax. specified.

⑤ Irregular voltage



UT(Transient voltage):excessive over-shooting peak value.

Us(Surge voltage):induced by switching or faults of the system or any part of it.

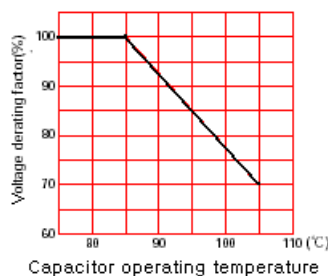
Uo-p including these irregular voltage < URDC at all times.

[11]Derating of rated voltage(UR)

The UR has to be derated,for operation at higher temperature and in AC circuit.

①where operating temperature is high

If capacitors are used in temperature exceeds +85°C(TR) but without exceeding +105°C(Tmax.),the UR has to be derated according to the graph below.



②when used in an AC circuit

If DC rated capacitors are used in an AC circuit,the operating AC voltage should be derated due to heat generation or corona discharge.

①at commercial frequency(50/60Hz),and an operating temperature of -40~+85°C(including self-heating),the URAC are specified below.

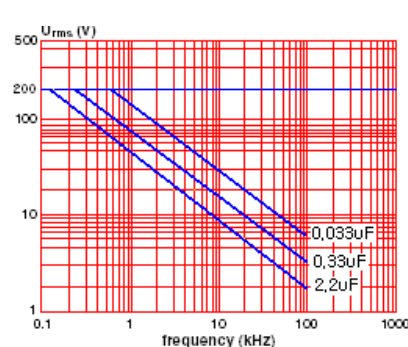
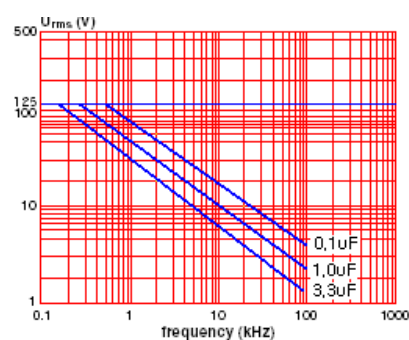
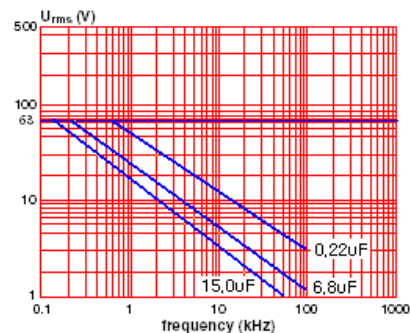
URDC	URAC(at 50/60Hz)	
100V	63Vrms	<p>*Not suitable for AC mains applications</p> <p>Even if, URAC of a capacitor covers AC mains voltage range,standard film capacitors in this series are basically not suitable for operation directly connected to AC mains(e.g.across the line).</p> <p>For these AC mains application,the CFS series are recommended.</p>
250V	125Vrms	
400V	200Vrms	
630V	220Vrms	
1000V	250Vrms	

②at high frequency(over 60Hz),derate the URAC according to the below "max. permissible AC rms voltage(Urms)-frequency" graphs, at Th=max.+85°C and ΔT=10°C.

URDC:100V ,URAC: 63Vrms(50/60Hz)

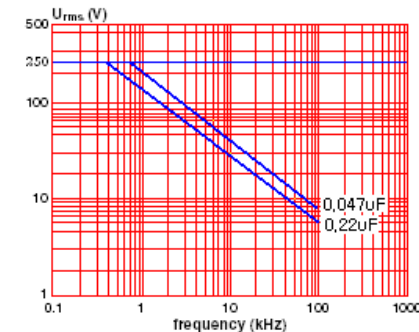
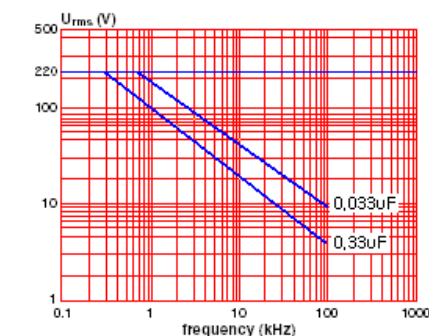
URDC:250V ,URAC:125Vrms(50/60Hz)

URDC:400V ,URAC:200Vrms(50/60Hz)



URDC:630V ,URAC:220Vrms(50/60Hz)

URDC:1000V ,URAC:250Vrms(50/60Hz)

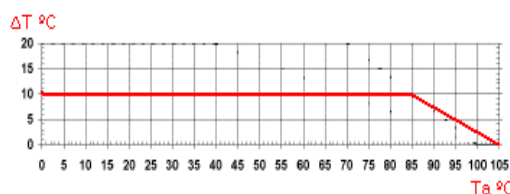


*The AC voltages mentioned refer to clean sinusoidal voltages without transients.

*max. permissible AC rms current(Irms)=2πf · C · Urms here, f:operating frequency in Hz
C:capacitance in F

Urms:obtained Urms from the above graph in V.

[12]Max. allowable ΔT



[13]Soldering operation

In soldering,heat stress to the capacitors has great influence on the change of characteristics of the capacitor,lead to an increase in failures(short circuit)and poor reliability.

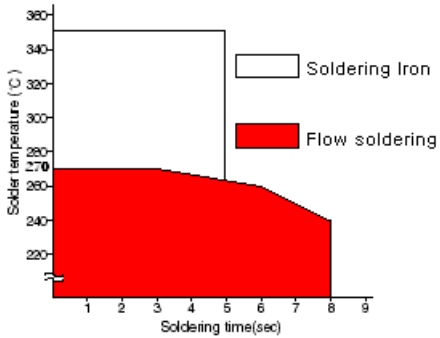
Apart from being dependent on the solder bath temperature and soldering time,the heat stress is also affected by initial (pre-heating) and the post-soldering (cooling)temperatures.

Ensure that the soldering process is within specified conditions shown in below.

- ①The temperature shown below,reflect the condition seen by the capacitor wire leads.
- ②Exposure of the capacitor body to excessive heat during pre-heat and soldering operations may result in damage to the capacitor.
- ③When combining with chip parts,avoid passing through an adhesive curing oven in order to cure the resin used for fixing. Otherwise,if the mounting heat resisting temperature is exceeded,the dielectric film will suffer heat shrinkage which induces short-circuiting.

Insert the capacitor and solder,after curing the adhesive.

- ④avoid reflow soldering.
- ⑤Soldering iron : The soldering iron should not make contact with the body of the capacitor.
- ⑥Flow soldering



Pre-heat:max.110°C within 1 min.

i)During the soldering,high temperature may cause cracking of the capacitor due to the characteristics of the epoxy resin which is used for external coating of capacitors.

Set the temperature and time so that the cracking may not occurred.

ii)Do not move the capacitor after soldering for a minimum of 20sec.

Failures by short or by opening may result.

iii)If re-work is needed,wait until the capacitor temperature is equal to room temperature.

Do not re-work more than twice.

*For further details,refer to [General technical information of film capacitors for use in electronics](#)