

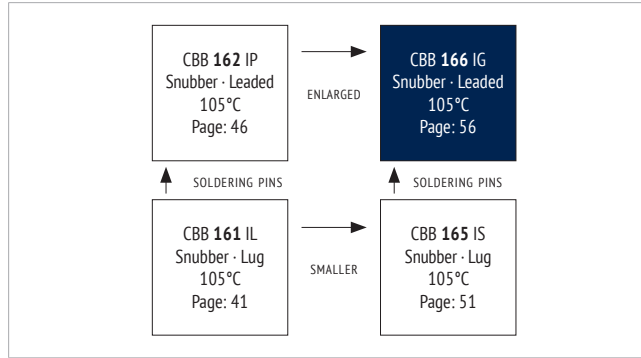
FILM CAPACITORS · SNUBBER

CBB 166 IG SERIES

FEATURES

- Very low dissipation factor
- Highest peak pulse capability
- Design for Snubber Application
- Self-healing
- Soldering Terminal

OVERVIEW



PRODUCT



APPLICATIONS

- High pulse and high frequency circuits
- IGBT applications

CHARACTERISTICS

ITEM	CHARACTERISTICS
Climatic Category	40/105/56 (IEC 61071)
Operating Temperature	-40 ~ +105 °C ($\Theta_{hotspot} \leq 105$ °C) $\Theta_{hotspot} = 85-105$ °C: See Voltage Derating Diagram
Storage Temperature	-40 ~ +105 °C
Rated Voltage U_{RDC}	850 ~ 2.000 V _{DC}
Capacitance Range	0,033 ~ 5,0 μ F
Capacitance Tolerance	± 10 % (K), ± 5 % (J)
Voltage between Terminals U_{TT}	$1,5 \cdot U_{RDC}$ (20 °C, 10s)
Voltage between Terminals & Case U_{TC}	≥ 3.000 V _{AC} (20 °C, 50 Hz, 10s)
Capacitor Dissipation Factor $\tan \delta$	$\leq 1 \cdot 10^{-3}$ (20 °C, 1 kHz)
Dielectric Dissipation Factor $\tan \delta_0$	$\leq 2 \cdot 10^{-4}$ (20 °C, 1 kHz)
Insulation Resistance R_i °C	≥ 10.000 M $\Omega \cdot \mu$ F (20 °C, 100 V _{DC} , 1 min)
Max. Overvoltage	Please see IEC 61071
Life Time Expectancy	≥ 100.000 h, failure rate ≤ 100 FIT (70 °C)
Reference Standard	IEC 61071:2007

ENVIRONMENTAL

The products are RoHS, WEEE and REACH compliant.

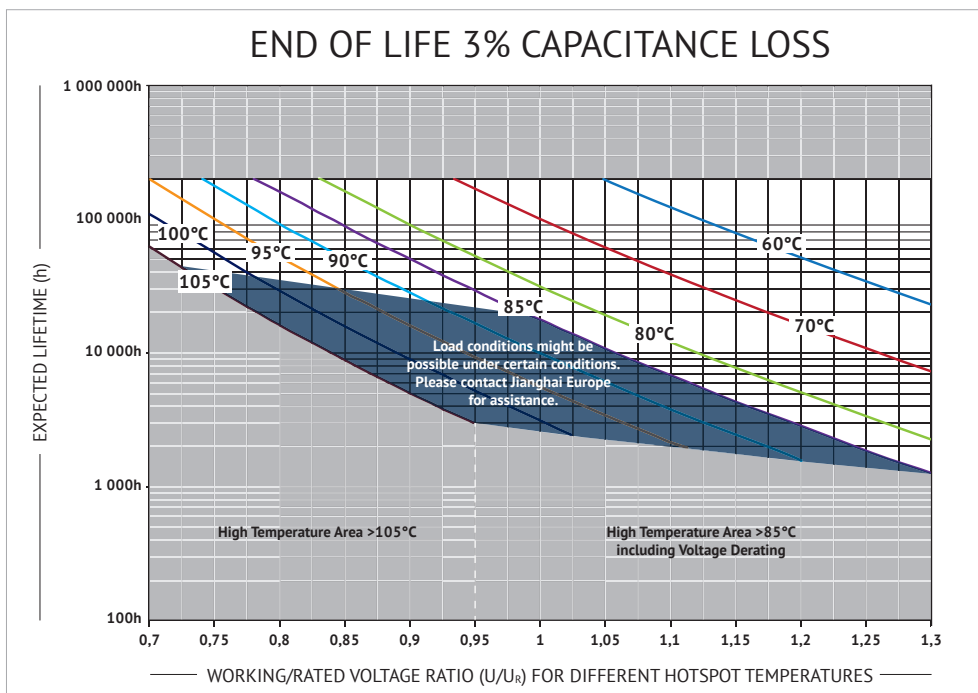
The detailed version please see separate "Environmental Certificates" document or www.jianghai-europe.com

APPROVALS

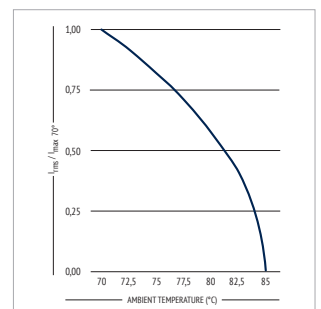
UL94-V0:

Plastic & Compound Mass

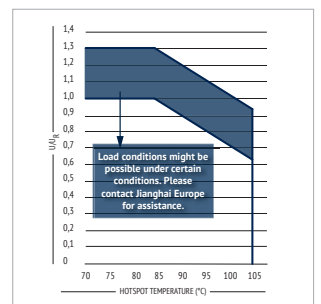
LIFETIME



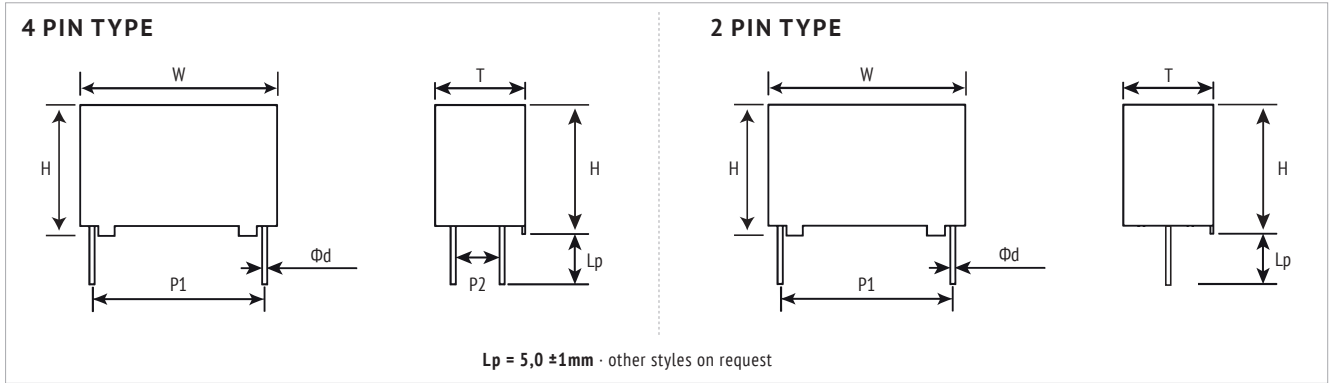
CURRENT DERATING



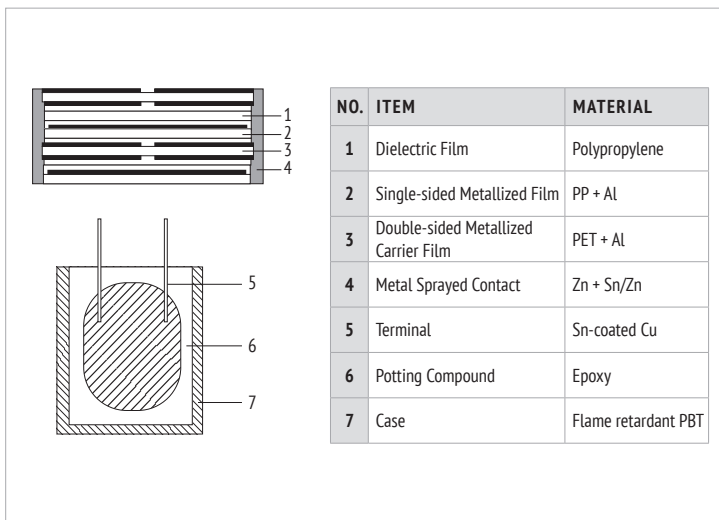
VOLTAGE DERATING



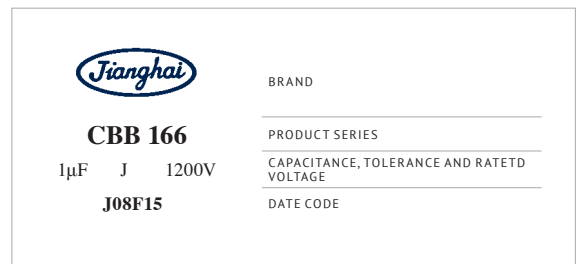
DIMENSIONS



INTERNAL CONSTRUCTION



MARKING



SNUBBER

ORDER CODE

FC	S	3B	IG	105	K	A	FA	37	20	C	E 3
Capacitor type	Product shape	DC rated voltage code (V)	Series code	Capacitance Code (µF)	Capacitance tolerance	Pin Style (mm)	Dimension Code (mm) W x H x T +1,0 +1,0 +1,0	Pitch P ₁ (mm)	Pitch P ₂ (mm)	Leadwire Diameter Ød	For internal use
Film Cap. - FC	Square box - S	850 K2 1000 3A 1200 3B 1600 3C 2000 3D	CBB 166 - IG	0,033 333 0,68 684 0,82 824 1,0 105 1,2 125 2,0 205 5,0 505	±5% J ±10% K	4 Pin Lp = 8mm K 4 Pin Lp = 5mm A 4 Pin Lp = 4,5mm L 4 Pin Lp = 4mm S 4 Pin Lp = 3,5mm J 2 Pin long leads (~ 20mm) C 2 Pin Lp = 5mm B 2 Pin Lp = 4,5mm T 2 Pin Lp = 4,0mm M 2 Pin Lp = 3,5mm U 2 Pin Lp = 3,2mm V	32 x 20 x 11 I4 32 x 22 x 13 I7 32 x 24,5 x 13 I8 32 x 28 x 14 IC 32 x 33 x 18 IF 32 x 37 x 22 II 42,5 x 37 x 28 F1 42,5 x 40 x 20 F2 42,5 x 32 x 19 F5 42,5 x 44 x 24 F9 42,5 x 45 x 30 FF 57,5 x 45 x 30 HH 57,5 x 50 x 35 HL	27,5 27 37,5 37 52,5 52	10,2 10 20,3 20 - 00	0,6 A 0,8 B 1,0 C 1,2 D 0,5 E	

RATINGS

U_R ≤85°C (V)	C_R (μF)	I_{max} 70°C, 100kHz (A)	$\hat{i}^{(1)}$ (A)	ESR_{typ} 20°C, 100kHz (mΩ)	dV/dt (V/μs)	L_S 20°C (nH)	W +1/-1,5 (mm)	H +1/-1,5 (mm)	T +1/-1,5 (mm)	P_1 ±0,5 (mm)	P_2 ±0,5 (mm)	ød ±0,05 (mm)	ORDER CODE ** to be defined, see ordering code table
850 V_{DC} 450 V_{AC} K2	0,15	8,0	195	14,5	1300	24	32	20	11	27,5	\	0,8	FCSK2IG154##I42700BE3
	0,22	10,0	286	10,5	1300	24	32	22	13	27,5	\	0,8	FCSK2IG224##I72700BE3
	0,33	12,0	429	7,6	1300	26	32	28	14	27,5	\	0,8	FCSK2IG334##IC2700BE3
	0,47	12,0	611	5,8	1300	26	32	33	18	27,5	\	0,8	FCSK2IG474##IF2700BE3
	0,68	12,0	884	4,6	1300	28	32	37	22	27,5	\	0,8	FCSK2IG684##II2700BE3
	1	22,0	800	5,9	800	30	42,5	40	20	37,5	10,2	1	FCSK2IG105##F23710CE3
	2	29,0	1600	3,9	800	30	42,5	44	24	37,5	10,2	1	FCSK2IG205##F93710CE3
	3	29,0	1500	5	500	35	57,5	45	30	52,5	20,3	1,2	FCSK2IG305##HH5220DE3
	4	29,0	2000	4,2	500	35	57,5	45	30	52,5	20,3	1,2	FCSK2IG405##HH5220DE3
5	29,0	2500	3,9	500	35	57,5	50	35	52,5	20,3	1,2	FCSK2IG505##HL5220DE3	
1000 V_{DC} 500 V_{AC} 3A	0,15	8,0	210	14	1400	24	32	20	11	27,5	\	0,8	FCS3AIG154##I42700BE3
	0,22	9,0	308	9,9	1400	24	32	22	13	27,5	\	0,8	FCS3AIG224##I72700BE3
	0,33	10,0	462	7,2	1400	26	32	28	14	27,5	\	0,8	FCS3AIG334##IC2700BE3
	0,47	12,0	658	5,6	1400	26	32	33	18	27,5	\	0,8	FCS3AIG474##IF2700BE3
	0,68	12,0	612	4,4	900	28	32	37	22	27,5	\	0,8	FCS3AIG684##II2700BE3
	1	16,0	900	5,5	900	30	42,5	40	20	37,5	10,2	1	FCS3AIG105##F23710CE3
	1,5	16,0	1350	4,2	900	30	42,5	37	28	37,5	10,2	1	FCS3AIG155##F13710CE3
	2	18,0	1800	3,7	900	30	42,5	45	30	37,5	20,3	1,2	FCS3AIG205##FF3720DE3
	2,2	18,0	1980	3,6	900	30	42,5	45	30	37,5	20,3	1,2	FCS3AIG225##FF2720DE3
	3	20,0	1650	4,7	550	35	57,5	45	30	52,5	20,3	1,2	FCS3AIG305##HH5220DE3
	4	22,0	2200	4,2	550	35	57,5	50	35	52,5	20,3	1,2	FCS3AIG405##HL5220DE3
4,7	24,0	2585	3,9	550	35	57,5	50	35	52,5	20,3	1,2	FCS3AIG475##HL5220DE3	
1200 V_{DC} 600 V_{AC} 3B	0,1	7,0	160	18,5	1600	24	32	20	11	27,5	\	0,8	FCS3BIG104##I42700BE3
	0,15	10,0	240	12,8	1600	24	32	22	13	27,5	\	0,8	FCS3BIG154##I72700BE3
	0,22	12,0	352	9,2	1600	26	32	28	14	27,5	\	0,8	FCS3BIG224##IC2700BE3
	0,33	12,0	528	6,7	1600	26	32	33	18	27,5	\	0,8	FCS3BIG334##IF2700BE3
	0,47	12,0	752	5,3	1600	28	32	37	22	27,5	\	0,8	FCS3BIG474##II2700BE3
	0,68	16,0	680	6,6	1000	30	42,5	40	20	37,5	10,2	1	FCS3BIG684##F23710CE3
	1	18,0	1000	5,1	1000	30	42,5	40	20	37,5	10,2	1	FCS3BIG105##F23710CE3
	1,2	18,0	1200	4,4	1000	30	42,5	37	28	37,5	10,2	1	FCS3BIG125##F13710CE3
	2	20,0	1200	5,5	600	35	57,5	45	30	52,5	20,3	1,2	FCS3BIG205##HH5220DE3
	2,2	20,0	1320	5,2	600	35	57,5	45	30	52,5	20,3	1,2	FCS3BIG225##HH5220DE3
	2,5	22,0	1500	4,8	600	35	57,5	45	30	52,5	20,3	1,2	FCS3BIG255##HH5220DE3
	3	22,0	1800	4,5	600	35	57,5	50	35	52,5	20,3	1,2	FCS3BIG305##HL5220DE3
	3,3	24,0	1980	4,1	600	35	57,5	50	35	52,5	20,3	1,2	FCS3BIG335##HL5220DE3
	1600 V_{DC} 650 V_{AC} 3C	0,1	8,0	190	13,5	1900	24	32	22	13	27,5	\	0,8
0,15		9,0	285	10,5	1900	24	32	24,5	13	27,5	\	0,8	FCS3CIG154##I82700BE3
0,18		10,0	342	9,5	1900	26	32	28	14	27,5	\	0,8	FCS3CIG184##IC2700BE3
0,22		12,0	418	8	1900	26	32	33	18	27,5	\	0,8	FCS3CIG224##IF2700BE3
0,27		12,0	513	7	1900	26	32	33	18	27,5	\	0,8	FCS3CIG274##IF2700BE3
0,33		12,0	627	6,8	1900	28	32	37	22	27,5	\	0,8	FCS3CIG334##II2700BE3
0,39		12,0	741	6,5	1900	28	32	37	22	27,5	\	0,8	FCS3CIG394##II2700BE3
0,47		16,0	588	6	1250	30	42,5	32	19	37,5	\	1	FCS3CIG474##F53700CE3
0,68		18,0	850	5	1250	30	42,5	40	20	37,5	10,2	1	FCS3CIG684##F23710CE3
0,82		18,0	1025	5	1250	30	42,5	44	24	37,5	10,2	1	FCS3CIG824##F93710CE3
1		19,0	1250	4,8	1250	30	42,5	45	30	37,5	20,3	1,2	FCS3CIG105##FF3720DE3
1,2		19,0	1500	4,8	1250	30	42,5	45	30	37,5	20,3	1,2	FCS3CIG125##FF3720DE3
1,5		20,0	1125	4,5	750	35	57,5	45	30	52,5	20,3	1,2	FCS3CIG155##HH5220DE3
2		22,0	1500	4,2	750	35	57,5	50	35	52,5	20,3	1,2	FCS3CIG205##HL5220DE3
2000 V_{DC} 700 V_{AC} 3D	0,033	5,0	76	42,5	2300	24	32	20	11	27,5	\	0,8	FCS3DIG333##I42700BE3
	0,047	6,0	108	30,5	2300	24	32	20	11	27,5	\	0,8	FCS3DIG473##I42700BE3
	0,068	8,0	156	20,8	2300	24	32	22	13	27,5	\	0,8	FCS3DIG683##I72700BE3
	0,1	10,0	230	15,2	2300	26	32	28	14	27,5	\	0,8	FCS3DIG104##IC2700BE3
	0,15	12,0	345	10,8	2300	26	32	33	18	27,5	\	0,8	FCS3DIG154##IF2700BE3
	0,22	12,0	506	7,8	2300	26	32	33	18	27,5	\	0,8	FCS3DIG224##IF2700BE3
	0,33	16,0	462	9,4	1400	30	42,5	40	20	37,5	10,2	1	FCS3DIG334##F23710CE3
	0,47	18,0	658	8,3	1400	30	42,5	44	24	37,5	10,2	1	FCS3DIG474##F93710CE3
	0,68	20,0	952	5,5	1400	30	42,5	45	30	37,5	20,3	1,2	FCS3DIG684##FF3720DE3
	1	22,0	850	7,3	850	35	57,5	45	30	52,5	20,3	1,2	FCS3DIG105##HH5220DE3
	1,5	24,0	1275	5,6	850	35	57,5	50	35	52,5	20,3	1,2	FCS3DIG155##HL5220DE3

(1) Maximum permissible peak current, (2) Thermal resistance from hotspot to ambient (free convection)

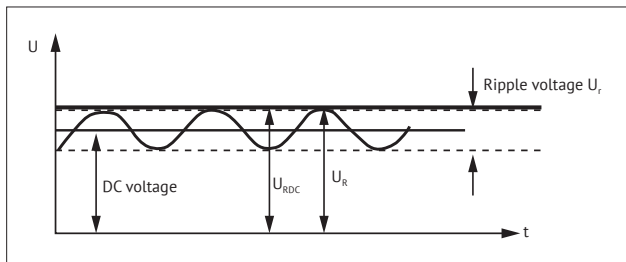
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WARRANTY The information contained in this datasheet does neither form part of any quotation nor of a contract, it is believed to be accurate, reliable and up to date. Quality data are based on the statistical evaluations of a large quantity of parts and do not constitute a guarantee in a legal sense. However, agreement on these specifications does mean that the customer may claim for replacement of individual defective capacitors within the terms of delivery. We cannot assume any liability beyond the replacement of defective components. This applies in particular to any further consequences of component failure. Furthermore it must be taken into consideration that the figures stated for lifetime and failure rates refer to the average production status and are therefore to be understood as mean values (statistical expectations) for a large number of delivery lots of identical capacitors. These figures are based on application experience and data obtained from preceding tests under normal conditions, or – for purpose of accelerated aging – more severe conditions. JIANGHAI reserves the right to change these specifications without prior notice. Any application information given is advisory and does not form part of any specification. The products are not primarily designed for use in life supporting applications, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. JIANGHAI customers using or selling these products for use in such applications without prior written consent of JIANGHAI do so at their own risk and agree fully to indemnify JIANGHAI for any damage resulting from such improper use or sale. This version of the datasheet supersedes all previous versions.

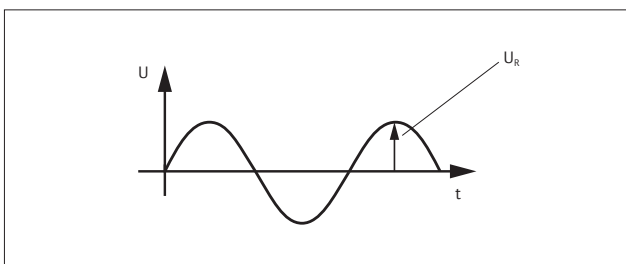
NOMINAL CAPACITANCE C_R Nominal Capacitance is defined at 20°C and 50Hz (120Hz).

RATED VOLTAGE U_R

DC Capacitors: U_{RDC} Maximum operating peak voltage of either polarity but of a non-reversing type waveform, for which the capacitor has been designed, for continuous operation. The maximum DC voltage is the sum of the DC voltage and peak AC voltage.



AC Capacitors: U_{RAC} Maximum operating peak recurrent voltage of either polarity of a reversing type waveform for which the capacitor has been designed.



OPERATING VOLTAGE The plastic film capacitor varies in the maximum applicable voltage depending on the applied voltage waveform, current waveform, frequency, ambient temperature (capacitor surface temperature), capacitance value, etc. Be sure to use capacitors within the specified values by checking the voltage waveform, current waveform, and frequency applied to them (In the application of high frequency, the permissible voltage varies with the type of the capacitor. Refer to the specification for details. See also Voltage Derating tables.).

NON-RECURRENT SURGE VOLTAGE U_S Peak voltage induced by a switching or any other disturbance of the system which is allowed for a limited number of times and for durations shorter than the basic period.

- Maximum duration: 50 ms / pulse

- Maximum number of occurrences: 1000 (during load)

MAXIMUM RATE OF VOLTAGE RISE dV/dt Maximum permissible repetitive rate of voltage rise of the operational voltage.

OPERATING CURRENT Due to the fact that the dissipation factor of the capacitor is greater than zero, heat will be generated in any application where alternating currents or pulses occur. The resulting internal temperature rise may cause a severe deterioration of the capacitor's withstanding voltage, or may lead to a breakdown (even smoke or fire may result). Therefore, the safe use of capacitor must be within the rated voltage (or category voltage) and the permissible current ranges. The rated current must be considered by dividing into pulse current (peak current) and continuous current (rms current) depending on the break down mode, and when using, should make sure the both currents are within the permissible range.

MAXIMUM CURRENT I_{MAX} Maximum Rms Current for continuous operation, see Current Derating tables.

MAXIMUM PEAK CURRENT \hat{I} Maximum permissible repetitive peak current which can occur during continuous operation. $\hat{I} = C_R \cdot (dV/dt)$

MAXIMUM SURGE CURRENT \hat{I}_S

- Maximum duration: 50 ms / pulse

- Maximum number of occurrences: 1000 (during load)

SERIES RESISTANCE R_S Effective ohmic resistance of the conducting elements of the capacitor.

EQUIVALENT SERIES RESISTANCE ESR The ESR represents all ohmic resistances: $ESR = \tan\delta/(\omega C) = R_S + \tan\delta/(\omega C)$

DIELECTRIC DISSIPATION FACTOR $\tan\delta$ Constant dissipation factor of the dielectric material.

LOSS FACTOR $\tan\delta$ The dissipation factor is the ratio between the reactive and effective power.

HOTSPOT TEMPERATURE $\Theta_{HOTSPOT}$ Temperature at the hottest position inside the capacitor. $\Theta_{hotspot} = \Theta_{ambient} + P_{loss} \cdot R_{th}$

R_{th} : thermal resistance, P_{loss} : Powerloss $P_{loss} = ESR \cdot I_{rms}^2$, $\Theta_{ambient}$ = ambient temperature

CHARGING AND DISCHARGING Because the charging and discharging current of capacitor is obtained by the product of voltage rise rate (dV/dt) and capacitance, low voltage charging and discharging may also cause deterioration of capacitor such as shorting and open due to sudden charging and discharging current. When charging and discharging, pass through a resistance of 20Ω/V to 1000Ω/V or more to limit the current. When connecting multiple film capacitors in parallel in withstand voltage test or life test, connect a resistance of 20Ω/V to 1000Ω/V or more in series to each capacitor. In addition, **capacitors must be discharged via a resistor before handling**. Because the capacitors do not have any discharge resistors built-in, there is a risk of residual voltages and electric energy contents that might be dangerous.

TEMPERATURE RANGE AND ALTITUDE Use film capacitors only within the specified operating temperature range. The altitude and barometric pressure have an impact on the functionality of the capacitor. Max. Altitude: 2000m above sea level.

ALTITUDE/m	CURRENT DERATING COEFFICIENT
≤ 2 000	1,00
2 500	0,95
3 000	0,90
3 500	0,85
4 000	0,80
4 500	0,75
5 000	0,70

EXPECTED LIFETIME The expected lifetime of the capacitor depends on the applied voltage and the hot spot temperature during operation. For capacitors applied in different situations, the obtainable average service lives are different. Please refer to the life time diagrams of each series.

FAILURE RATE λ (FAILURE IN TIME FIT) 1 FIT = 1/10⁹h (1 failure per 10⁹ components test hours), $\lambda = r/(nt)$

r = number of failure, n = test number, t = test time

INSULATION VOLTAGE U_i Rms value of AC voltage designed for the insulation between terminals of the capacitor to case or earth. The insulation voltage is equal to the rated voltage of the capacitor, divided by, unless otherwise specified.

INSULATION RESISTANCE R_i Ratio between applied DC Voltage and resulting leakage current after 1 minute of charge. It is defined in MΩ. Typically it is given as time constant $R_i \cdot C$ [μF] in seconds.

VOLTAGE BETWEEN TERMINALS U_{TT} Voltage between terminals.

VOLTAGE BETWEEN TERMINALS AND CASE U_{TC} Voltage between terminals and case.

BUZZING NOISE Any buzzing noise produced by a capacitor is caused by the vibration of the film due to the Coulomb force that is generated between the electrodes with opposite poles. It is of no harm to the capacitor.

SURFACE OVER TEMPERATURE $\Delta\theta_{case}$ When current continuously flow through the capacitor, the temperature inside the capacitor will rise induced by dissipated heat. If the temperature exceeds the maximum allowed hot-spot temperature, it might cause a short circuit or fire. The limits described in the catalogue must not be exceeded and it's necessary to check the temperature on the capacitor's surface in operation.

FLAME RETARDATION Although flame retarding PU resin or plastic case material is used in the coating or encapsulation of plastic film capacitors, continuous exposure to high temperature ambient or fire will break the coating layer or plastic case of the capacitor, and may lead to melting and ignition of the capacitor element.

HUMID AMBIENT If used for a long time in a humid ambient, the capacitor might absorb humidity and oxidize the electrodes causing damage to the capacitor. In case of AC application, high humidity would increase the corona effect. This phenomenon causes a drop in capacitance and an increase of capacitor losses. Humidity needs to be avoided. If needed please inform Jianghai separately for technical adopted components.

STORAGE CONDITIONS 1) Capacitors must not be stored in corrosive atmospheres, particularly not when chlorides, sulfides, alkali, acids, lye, salts, organic solvents or similar substances are present. 2) It must not be stored in high temperature and/or high humidity environments. The following storage conditions must be kept (applicable only for storage in the original package): Temperature: $\leq 35\text{ }^{\circ}\text{C}$; Humidity: $\leq 80\%$ RH, no dew allowed on the capacitor; Storage time: ≤ 24 months

MOUNTING Other devices, which are mounted near the capacitor, should not touch the capacitor. Additional heat coming from other components near the capacitor may reduce the lifetime of the capacitor. Do never attempt to bend or twist the capacitor after mounting and avoid any mechanical stress on the terminals. Never exceed the max. permissible torques when tightening the terminal screws or the mounting bolt's cap nuts.

CAUTION & WARNINGS Do not touch the terminals of capacitors. The energy stored in capacitors may be lethal. Ensure that the operating environment of the equipment into which the capacitor has been built, is within the specified conditions. Capacitors must not be used in corrosive atmospheres, particularly not when chlorides, sulfides, alkali, acid, lye, salts, organic solvents or similar substances are present. Electrical or mechanical misapplication may be hazardous. Personal injury or property damage may result from bursting of the capacitors or from expulsion of melted material.

Jianghai Europe GmbH, v5 0123