



# SPECIFICATION FOR APPROVAL

File No.: Q/FRK 0.GS.E.C45-C14

Product Name	Metallized Polypropylene Film Interference Suppression Capacitor (Class X1: 440Vac/480Vac)
Product Type	MKP65
Product Code	C45S3474K9WC322
Customer	
Customer Code	
Issue Date	2023-05

<b>Xiamen Faratronic Co. Ltd.</b>			Approved by Customer
Drafted	Checked	Approved	



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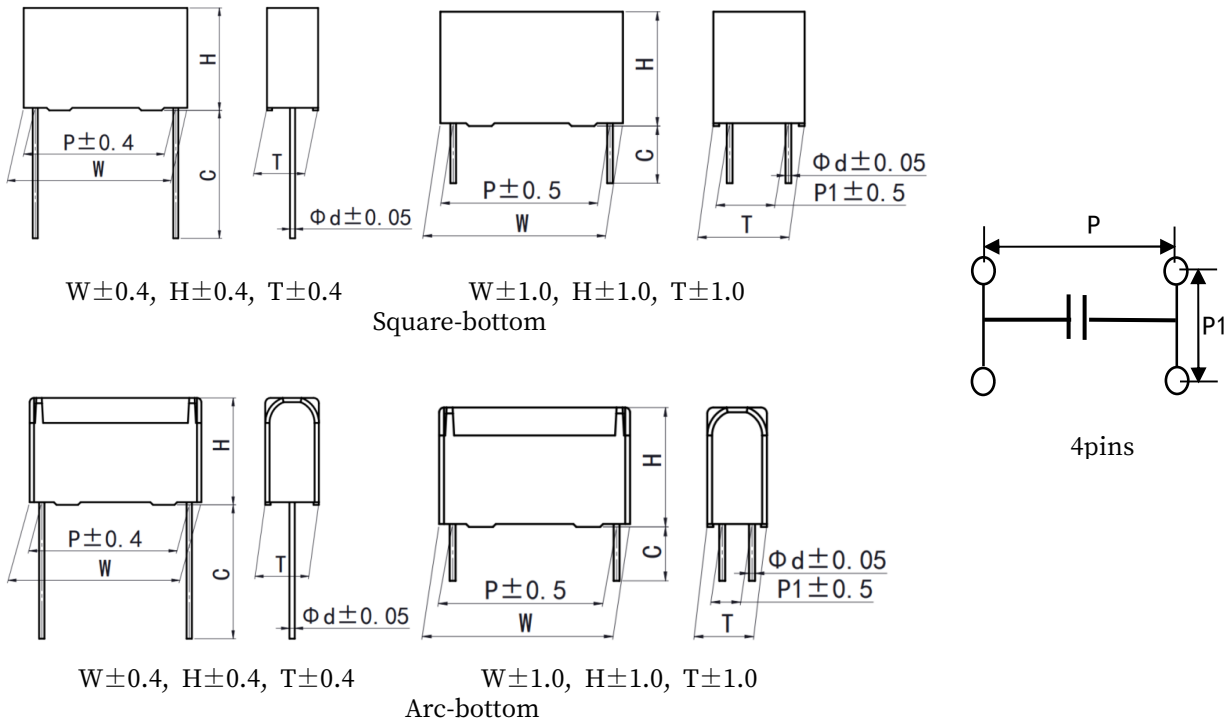
### Version history

Current version	Date	Author	Change description



Metallized polypropylene film interference suppression capacitor (Class X1, 440Vac/480Vac)

■ Outline Drawing



■ Features

- Metallized polypropylene structure
- Compact size
- Withstanding overvoltage stressing
- Excellent active and passive flame resistant abilities
- Used in across-the-line, interference suppression circuit.

■ Safety Approvals

●		CQC	IEC 60384-14:2013, X1, 440Vac/480Vac, 0.0010 $\mu$ F~10.0 $\mu$ F, 40/110/56/B Certificate No.: CQC06001016942
●		ENEC-VDE	EN 60384-14:2013+A1:2016, X1, 440Vac/480Vac, 0.0010 $\mu$ F~10.0 $\mu$ F, 40/110/56/B Certificate No.: 40021925
●		UL/CUL	UL60384-14:2014, CSA E60384-14:09, X1, 440Vac/480Vac, 0.0010 $\mu$ F~10.0 $\mu$ F, 40/110/56/B File No.: E186600, CCN: FOWX2/8

**■ Specifications**

Class	Class X1		
Climatic Category / Passive Flammability Category	40/110/56/B		
Operating Temperature Range	-40°C ~ +110°C		
Rated Voltage (U <sub>R</sub> )	480Vac, 50/60Hz		
Maximum continuous DC voltage	1 000Vdc		
Capacitance Range	0.47μF		
Capacitance Tolerance	±10%(K), ±20%(M)		
Voltage Proof	Between Terminals:	4.3U <sub>R</sub> (dc), 2s	
	Between Terminals To Case:	2560 (Vac), 1min	
Insulation Resistance	$R \geq 15\,000\text{M}\Omega$ , $C_N \leq 0.33\mu\text{F}$ $RC_N \geq 5\,000\text{s}$ , $C_N > 0.33\mu\text{F}$ (20°C, 100V, 1min)		
Dissipation Factor(tanδ)	0.0010μF < CN ≤ 0.010μF	≤ 25×10 <sup>-4</sup> (1kHz, 20°C)	≤ 25×10 <sup>-4</sup> (10kHz, 20°C)
	0.010μF < CN ≤ 0.47μF	≤ 15×10 <sup>-4</sup> (1kHz, 20°C)	≤ 20×10 <sup>-4</sup> (10kHz, 20°C)
	0.47μF < CN ≤ 1.0μF	≤ 20×10 <sup>-4</sup> (1kHz, 20°C)	≤ 40×10 <sup>-4</sup> (10kHz, 20°C)
	1.0μF < CN	≤ 30×10 <sup>-4</sup> (1kHz, 20°C)	-----
Note: 1. If used in application which has ripple current applied, recommend to use AC filter series: C6A etc. If have any questions please contact our technical engineer for more detail; 2. For outdoor or severe humidity condition application, recommend to use THB series.			



■ Part number system

The 15 digits part number is formed as follow:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	4	5												

- Digit 1 to 3      Series code  
C45=MKP65
- Digit 4 to 5      A.C. rated voltage  
S1=440V   S3=480V
- Digit 6 to 8      Rated capacitance value  
For example : 103=10×10<sup>3</sup> pF= 0.01μF
- Digit 9            Capacitance tolerance  
K=±10%, M=±20%
- Digit 10          Pitch  
3=7.5 mm   4=10.0mm   6=15.0mm   9=22.5mm  
B=27.5mm   F=37.5mm   M=52.5mm
- Digit 11          Internal use
- Digit 12 to 15    Lead form and packaging code

Table1 Lead form and packaging code

Digit 12		Digit 13		Digit 14		Digit 15	
code	explanation	code	explanation	code	explanation	code	explanation
A	ammo-pack	4 6	F=10.0mm F=15.0mm	0	straight	5	P3=25.4mm;H=18.5mm pitch=10/15mm) (For
C	straight lead “C” in the figure above	code	explanation	0		0 2	Length tolerance ±0.5mm Or standard length Length tolerance ±0.3mm
		00	standard lead length (18mm~26mm)				
		45 32	lead length 4.5mm lead length 3.2mm				
T 3	P1=20.3mm ± 0.5mm P1=20mm±0.5mm	38 45	lead length 3.8mm lead length 4.5mm	0		0	Length tolerance ± 0.5mm or standard length

Note: Recommend short lead due to long lead could deform easily.



## ■ Dimensions(mm)

THB version

480Vac						
$C_N$ ( $\mu F$ )	W	H	T	P	d	Part number
0.47	26.5	24.5	15.5	22.5	0.8	C45S3474K9WC322

- Note: 1. “-” =capacitance tolerance code, M= $\pm 20\%$ ,K= $\pm 10\%$   
 2. “\*\*\*\*\*” =lead form and packaging code (refer to table 1)  
 3. “#” when the rated voltage is 480Vac,the digit 4~5 is S3.  
 4. “★” = Arc bottom of the outer shell

## ■ Maximum permissible voltage change per unit of time

Rated Voltage (Vac)	dV/dt(V/us) at 680 Vdc				
	P=10mm	P=15mm	P=22.5mm	P=27.5mm	P=37.5mm
440	750	600	300	225	150

- Note: 1. Rated voltage pulse slope  $(dV/dt)_R$  at rated voltage.  
 2. If the working voltage(U) is lower than the rated voltage( $U_R$ ),the capacitor can be worked at a higher dV/dt. In this case, the maximum allowed dV/dt is obtain by multiplying the right value with  $U_R/U$ .



■ Test Method And Performance (IEC 60384-14)

Group	Item	Conditions of test	Performance requirements
A1	4.1 Visual examination	Dimensions: gauging by vernier caliper	No visible damage & legible marking
	4.1Dimensions(Gauging)		Fit detail specification
A2	4.2.2 Capacitance	Measuring frequency: Capacitance: 1kHz Tangent of loss angle: CN ≤ 1μF: 10kHz; CN > 1μF: 1kHz Voltage proof between terminals: 4.3UR(d.c.), 1min IR. test voltage: 100Vd.c.	Within specified tolerance
	4.2.3 Tangent of loss angle		No permanent breakdown or flashover
	4.2.1 Voltage proof		
	4.2.5 Insulation Resistance		I.R.: ≥ the rated value
B1	4.5 Solderability	Methods: Groove welding Ta, Method 1 Solder temperature: 245°C±5°C Immersion time: 2.0s±0.5s	Good quality of tinning
C1A	Initial measurement	4.1 Visual examination	No visible damage & legible marking
		4.1Dimensions(Gauging)	Fit detail specification
		4.2.2Capacitance	Within specified tolerance
		4.2.3Tangent of loss angle	
	4.1.1 Creepage distances and Clearances	Gauging by vernier caliper	Creepage distances ≥ 4.0mm Clearances ≥ 3.0mm
	4.3 Robustness of Terminations (straight lead)	Tense: 0.50 < d ≤ 0.80, 10N 0.80 < d ≤ 1.25, 20N Ub bending test: Bend: 0.50 < d ≤ 0.80, 5N 0.80 < d ≤ 1.25, 10N The terminals shall be bent 2 times in each direction	No visible damage
	4.4 Resistance to Soldering heat	Capacitors are not pre-dried Groove Method Tb, Method 1A Solder temperature: 260°C±5°C Immersion time: 10s±1s	No visible damage & legible marking
4.19 Component solvent resistance	Solvent: industrial isopropyl Solvent temperature: 23°C±5°C Dipping time: 5min±0.5min Method 2: (without Sassafras test) Recovery time: 48h	Comply with the specifications in the product size table	
	Final measurement	Appearance inspection Cap. measuring frequency: 1kHz Tangent of loss angle: CN ≤ 1μF: 10kHz; CN > 1μF: 1kHz	No visible damage Cap.:   ΔC   / C ≤ 5% Tangent of loss angle: CN ≤ 1μF: ≤ 0.008 (10kHz) CN > 1μF: ≤ 0.005 (1kHz)



Group	Item	Conditions of test	Performance requirements	
C1B	Initial measurement	4.1 Visual examination	No visible damage & legible marking	
		4.1 Dimensions (Gauging)		Dimensions: gauging by vernier caliper
		4.2 Capacitance		Measuring frequency: 1kHz
		4.2.3 Tangent of loss angle		Capacitance: 1kHz Tangent of loss angle: $C_N \leq 1\mu\text{F}$ : 10kHz; $C_N > 1\mu\text{F}$ : 1kHz
	4.5 Solderability	Methods: Groove welding Ta, Method 1 Solder temperature: $245^\circ\text{C} \pm 5^\circ\text{C}$ Immersion time: $2.0\text{s} \pm 0.5\text{s}$	Fit detail specification	Within specified tolerance
	4.20 Solvent resistance of the marking	Solvent: Industrial isopropanol. Solvent temperature: $23^\circ\text{C} \pm 5^\circ\text{C}$ Dipping time: $5\text{min} \pm 0.5\text{min}$ Condition: scrub Scrub material: absorbent cotton Reverting time: No	Good quality of tinning	The marking shall be legible
	4.6 Rapid change of temperature	$T_A = -40^\circ\text{C}$ , $T_B = +110^\circ\text{C}$ 5 cycles, Duration: $t=30\text{min}$	No visible damage	No visible damage
	4.7 Vibration (straight lead)	Amplitude 0.75mm or acceleration $98\text{m/s}^2$ (whichever is the smaller severity), f: 10Hz to 500Hz. Three directions, 2h for each direction, total 6h.	No visible damage	No visible damage
4.8 Bump (straight lead)	4 000 times, Acceleration: $400\text{m/s}^2$ , Pulse duration, 6ms	No visible damage	No visible damage	
	Final measurement	Appearance inspection Cap. measuring frequency: 1kHz	No visible damage Cap.: $ \Delta C /C \leq 5\%$	
C1	4.11 Climatic sequence	Initial measurement	According to the conditions of Group C1A and C1B	According to the requirements of Group C1A and C1B
		Dry heat	+110°C, 16h	No visible damage & legible marking
		Damp heat, Cyclic	Test Db, Severity: b, the first cycle Temperature: +55°C, 24h each cycle, Method 2	
		Cold	-40°C, 2h	
		Damp heat, Cyclic	Test Db, Severity b, the other cycles Temperature: +55°C, 24h each cycle, Method 2	
		Final measurement	Measuring frequency: Capacitance: 1kHz Tangent of loss angle: $C_N \leq 1\mu\text{F}$ : 10kHz; $C_N > 1\mu\text{F}$ : 1kHz Voltage proof between terminals: 4.3 $U_R$ (d.c.), 1min Voltage proof between terminal and housing: $2U_R + 1500\text{V}$ (a.c.), 1min Insulation resistance test voltage: 100Vd.c.	Cap.: $ \Delta C /C \leq 5\%$ Increase of $\text{tg}\delta$ : $C_N \leq 1\mu\text{F}$ : $\leq 0.008$ (10kHz) $C_N > 1\mu\text{F}$ : $\leq 0.005$ (1kHz) No permanent breakdown or flashover I.R.: $\geq 50\%$ of the rated value

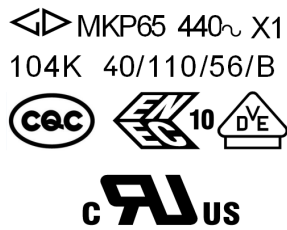




Group	Item	Conditions of test	Performance requirements
C2	4.12 Damp heat, steady state	Temperature: 40°C ±2°C Humidity: 93±3%RH Duration: 56 days	No visible damage & legible marking Cap.:   ΔC   /C ≤5% Increase of tgδ: C <sub>N</sub> ≤1μF: ≤0.008 (10kHz) C <sub>N</sub> >1μF: ≤0.005 (1kHz) No permanent breakdown or flashover I.R.: ≥50% of the rated value
	Final measurement	Tangent of loss angle: C <sub>N</sub> ≤1μF: 10kHz; C <sub>N</sub> >1μF: 1kHz Voltage proof between terminals: 4.3U <sub>R</sub> (d.c.),1min Voltage proof between terminal and housing: 2U <sub>R</sub> +1500V(a.c.),1min Insulation resistance test voltage: 100Vd.c.	
C3	Initial measurement	Measuring frequency capacitance: 1kHz Tangent of loss angle: C <sub>N</sub> ≤1μF: 10kHz; C <sub>N</sub> >1μF: 1kHz Insulation resistance test voltage: 100Vd.c.	Within specified tolerance
	4.13 Impulse voltage	Each individual capacitor shall be subjected to 24 impulses of the same polarity, the time between impulses shall not be less than 10S, and the peak value of the voltage impulse: 4.0kV (suitable for C <sub>N</sub> ≤1μF; When C <sub>N</sub> >1μF, the capacitor can endure pulse voltage value is 4.0/√C <sub>N</sub> kV)	There are three or more waveforms which indicate that no self-heating breakdown have occurred when it is monitored by the monitor (when any three successive impulses are shown by the monitor to have a wave form indicating that no self-healing breakdown have taken place the impulses can be stopped)
	4.14 Endurance	Temperature : +110°C Duration : 1000h Voltage: at 1.25 U <sub>R</sub> except that once every hour the voltage shall be increased to1000Vrms for 0.1s; and each capacitor individually through a resistor of 47.0Ω±5 %.	No visible damage & legible marking Cap.:   ΔC   /C ≤10% Increase of tgδ: C <sub>N</sub> ≤1μF: ≤0.008 (10kHz) C <sub>N</sub> >1μF: ≤0.005 (1kHz) No permanent breakdown or flashover I.R.: ≥50% of the rated value
	Final measurement	Tangent of loss angle: C <sub>N</sub> ≤1μF: 10kHz; C <sub>N</sub> >1μF: 1kHz Voltage proof between terminals: 4.3U <sub>R</sub> (d.c.),1min Voltage proof between terminal and housing: 2U <sub>R</sub> +1500V(a.c.),1min	

Group	Item	Conditions of test	Performance requirements
C4	4.15 Charging and discharging	Times: 10 000 Duration of charging: 0.5s Duration of discharging: 0.5s Charging voltage: $\sqrt{2}U_R$ Vd.c. Charging resistance: $220/C_N(\Omega)$ or the current $\leq 1.0A$ (whichever is the minor) Discharging resistance: $R = \frac{\sqrt{2}U_R}{C_N \times \frac{dU}{dt}} (\Omega)$ $C_N$ : Capacitance ( $\mu F$ ) $dU/dt(V/us)$ : 100V/ $\mu s$	Cap.: $ \Delta C /C \leq 10\%$ Increase of $tg\delta$ : $C_N \leq 1\mu F$ : $\leq 0.008$ (10kHz) $C_N > 1\mu F$ : $\leq 0.005$ (1kHz) I.R.: $\geq 50\%$ of the rated value
C6	4.17 Passive flammability	Needle flame test The category of flammability: B Expose time: 1 time Capacitor Volume    Exposing time $250 < V(mm^3) \leq 500$ 20s $500 < V(mm^3) \leq 1750$ 30s $V(mm^3) > 1750$ 60s	The flaming time of each capacitor shall not go beyond 10s after it is taken apart from the flame. Drop of each capacitor caused by flame shall not fire the tissue below.
C7	4.18 Active flammability	The specimens shall be individually wrapped in at least 1, but not more than 2, complete layers of cheesecloth, the cheesecloth shall be untreated pure cotton cloth. Each sample shall be subjected to 20 discharges, the interval between successive discharges shall be 5s. $U_i = 4.0kV_0^{+7} \%$ $U_R$ be applied and be maintained for $120_0^{+10}$ s after the last discharge.	The cheese cloth around the capacitor shall not burn with a flame.

■ Marking (For example)








P ≤ 27.5mm



P > 27.5mm

Marking Introduction:

Sign	explain	Sign	explain
	Brand	40/110/56/B	Climate category / Passive Flammability Class
MKP65	Type		CQC Approval
440~	Rated voltage	 10 	ENEC-VDE Approval
X1	Class		UL&CUL Approval
104K 475M	Rated capacitance and tolerance	L50005	

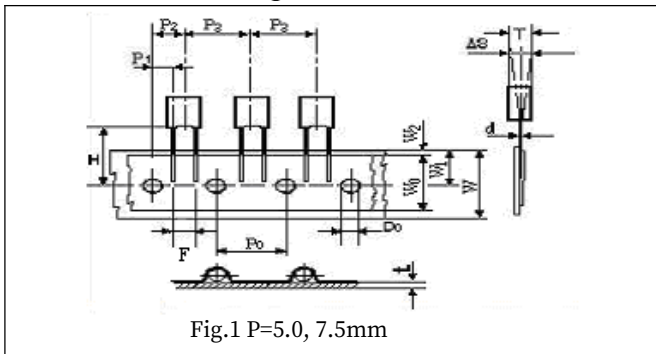
**■ Taping specification for box-type capacitors**
**▲ Outline Drawing**


Fig.1 P=5.0, 7.5mm

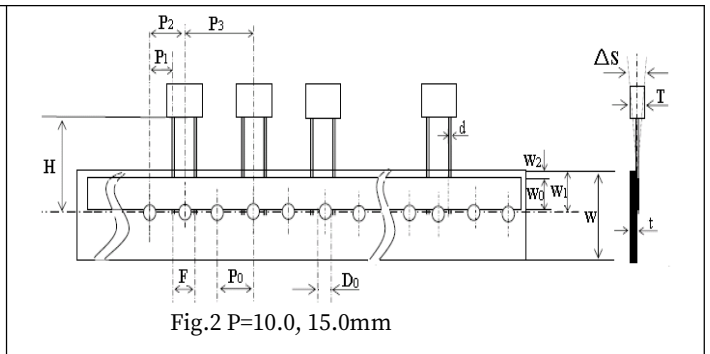


Fig.2 P=10.0, 15.0mm

**▲ Taping Dimensions(mm)**

Technology index title	Code	Dimensions				
		P=5.0	P=7.5	P=10.0	P=15.0	Tolerance
Taping type	—	Fig 1	Fig 1	Fig2	Fig 2	—
Part number	Ammo-pack	A201	A301	A405	A605	
Digit12-15						
Taping pitch	$P_3$	12.7	12.7	25.4	25.4	$\pm 1.0$
Feed hole pitch	$P_0$	12.7	12.7	12.7	12.7	$\pm 0.3$
Center of wire	$P_1$	3.85	2.6	7.7	5.2	$\pm 0.7$
Center of body	$P_2$	6.35	6.35	12.7	12.7	$\pm 1.3$
Pitch of taping wire	$F^{**}$	5.0	7.5	10.0	15.0	+0.6 -0.1
Component alignment	$\Delta S$	0	0	0	0	$\pm 2.0$
Height of component from tape center	$H^{***}$	18.5	18.5	18.5	18.5	$\pm 0.5$
Carrier tape width	W	18.0	18.0	18.0	18.0	+1.0 -0.5
Hold down tape width	$W_0$	6min	10min	10min	10min	—
Hole position	$W_1$	9.0	9.0	9.0	9.0	$\pm 0.5$
Hold down tape position	$W_2$	3max	3max	3max	3max	—
Feed hole dia.	$D_0$	4.0	4.0	4.0	4.0	$\pm 0.2$
Tape thickness	t	0.7	0.7	0.7	0.7	$\pm 0.2$

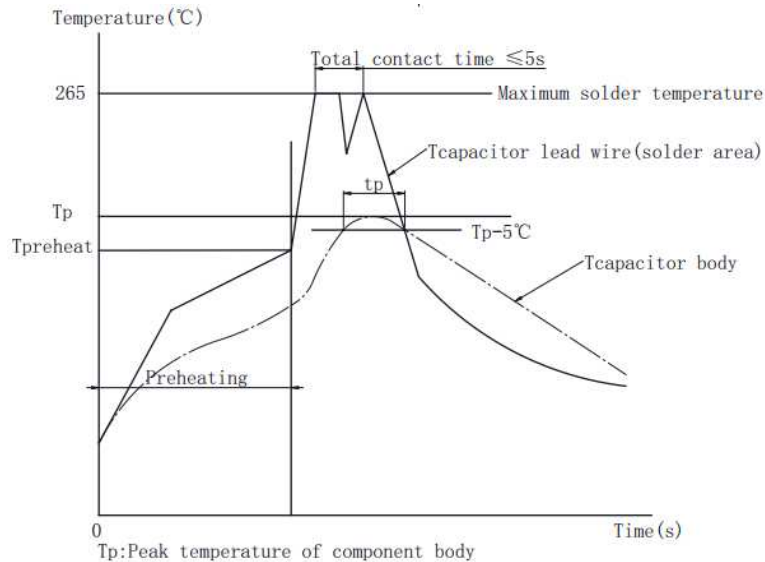
**Note:** \*  $P_0=15\text{mm}$  is also available;  
 \*\*F can be other lead spacing;  
 \*\*\*H=16.5mm is available;

■ Soldering suggestions

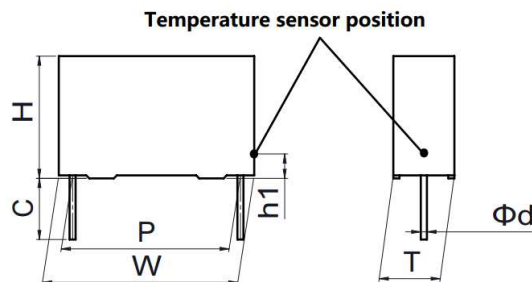
- ▲ Manual soldering  
Max. temperature: 350°C, time: 3s
- ▲ Wave soldering

There are many factors affecting the heating of film capacitor during the wave soldering process, such as: preheating temperature, preheating time, soldering temperature, soldering time, other heat sources influence and so on.

The typical soldering profile is as below:



▲ Because overheating could damage the capacitor, we recommend paying attention to the maximum capacitor temperature and heating time, use temperature sensor to detect the maximum capacitor body temperature.

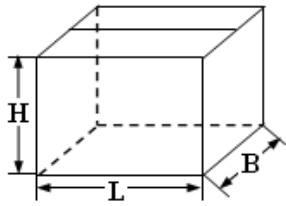


Note: If re-working or dipping twice is necessary, it should be done after the capacitor returns to the normal temperature.

Temperature sensor position (Tcapacitor body)	The capacitor body surface of lead side, capacitor height position from PCB: h1=2~3mm		
Maximum capacitor body temperature Tp(°C)	OPP film P≤15mm	OPP film P>15mm	PET film
	115	120	125
Maximum capacitor lead wire temperature (°C)	265	265	265
Maximum capacitor body heating time tp=Tp-5°C	30s		

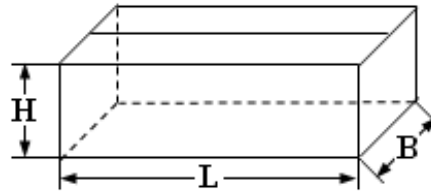
■ Packing box sizes(mm)(example)

1. Out packing box for bulk



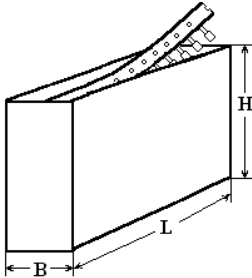
L:375±5  
B:375±5  
H:265±5

2. Inner packing box for bulk



L:355±3  
B:175±3  
H:118±3

3. Box sizes for Ammo-pack



L: 350 ± 3  
B: 50 ± 3  
H: 260 ± 3

■ Storage conditions

▲ It must be noted that the solderability of the terminals may be deteriorated when stored in an atmosphere filled with moisture, dust, or a reactive oxidizing gas.(hydrogen chloride, hydrogen sulfide, sulfuric acid,etc.)

▲ It shouldn't be located in particularly high temperature and high humidity, it must submit to the following conditions(unchanging primal package):

Temperature: -40 °C to 35 °C

Humidity: Average per year ≤70%RH;

For 30 full days randomly distributed throughout the year ≤80%RH

Storage time for tinned lead wire: (from the date marked on the capacitor's body or the label glued to the package) :

Bulk(packed with plastic bag): ≤24 months ;

Taping and line up: ≤12 months