MKP-X2-Z SERIES

HIGH STABILITY ▲ X2 ▲ RFI CAPACITOR

METALLIZED POLYPROPYLENE CAPACITOR ▲ THT type
In accordance with UL, CUL ENEC, CQC safety regulations
Flame retardant plastic case, epoxy resin sealed, UL 94V-0
Standard and continuous in series with the mains operation
Radio Frequency Interference RFI capacitor ▲ Safety class X2
Voltage divider ▲ Internal series construction

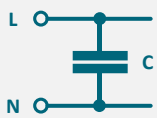
SPECIFICATION

Item		Characteristics				
Related Documents		UL 60384–14, IEC60384–14, EN60384–14, GB/T 6346.14–2015				
Rated Temperature Range		-40°C to +110°C				
Capacitance Range	C_R	0.01µF to 10µF				
Capacitance Tolerance	ΔC	±10% ▲ ±20%				
Rated Voltage	$V_{R\ AC}$	250V_{AC} to 310V_{AC}				
Insulation Resistance	R_{INS}	Terminal to Terminal	Terminal to Enclosure			
		≥ 15GΩ at 100V_{DC} (C_R ≤ 0.33µF)	≥ 30GΩ at 100V_{DC}			
		≥ 5GΩ × µF at 100V_{DC} (C_R > 0.33µF)	≥ 0.5GΩ at 500V_{DC}			
Dissipation Factor Note 1	tan δ	0.1% or less				
Permissible DC Voltage	V_{DC}	630V_{DC}				
Withstand Voltage	V_W	Between Terminal	2000V_{DC} for 3 sec			
		Between Terminal and Enclosure	2050V_{AC} for 1 min			
		Nothing abnormal shall be found				
Maximum Pulse Rise Slope dV/dt	Pitch (mm)	10.0mm	15.0mm	22.5mm	27.5mm	37.5mm
	630V_{DC}	400V/µs	300V/µs	180V/µs	120V/µs	100V/µs

Note:

1: Measured at 1kHz, 20±5°C

APPLICATIONS

Across the Line Filter	Capacitive Power Supplies	Industrial	Interference Suppressors
			

ELECTRICAL CHARACTERISTICS

$V_{R\ AC}$	C_R (µF)	Dimensions (mm)					tanδ (%) Note 1	Part Number Note 2
		W	H	T	P	Ød		
305V_{AC}	0.01	13	9	4	10	0.6	0.10	MKP-103□0305AB110□-Z
	0.047	13	12	6	10	0.6	0.10	MKP-473□0305AB110□-Z
	0.047	8	12	6	15	0.8	0.10	MKP-473□0305AB115□-Z
	0.068	18	12	6	15	0.8	0.10	MKP-683□0305AB115□-Z
	0.1	18	12	6	15	0.8	0.10	MKP-104□0305AB115□-Z
	0.15	18	13	7	15	0.8	0.10	MKP-154□0305AB115□-Z
	0.22	18	13.5	7.5	15	0.8	0.10	MKP-224□0305AB115□-Z
	0.33	18	16	9	15	0.8	0.10	MKP-334□0305AB115□-Z
	0.47	18	18	10	15	0.8	0.10	MKP-474□0305AB115□-Z
	0.56	18	19	11	15	0.8	0.10	MKP-564□0305AB115□-Z
	0.68	18	19	11	15	0.8	0.10	MKP-684M0305AB115□-Z
	0.22	26	14.5	6	22.5	0.8	0.10	MKP-224□0305AB122□-Z
	0.33	26	14.5	7	22.5	0.8	0.10	MKP-334□0305AB122□-Z
	0.47	26	16.5	7.5	22.5	0.8	0.10	MKP-474□0305AB122□-Z
	0.56	26	18.5	8.5	22.5	0.8	0.10	MKP-564□0305AB122□-Z
	0.68	26	18.5	8.5	22.5	0.8	0.10	MKP-684□0305AB122□-Z
	0.82	26	19	10	22.5	0.8	0.10	MKP-824□0305AB122□-Z
	1	26	20	11.5	22.5	0.8	0.10	MKP-105□0305AB122□-Z
	1.5	26	24	14	22.5	0.8	0.10	MKP-155□0305AB122□-Z
	2.2	26	25	15	22.5	0.8	0.10	MKP-225M0305AB122□-Z
	0.68	31	18	9	27.5	0.8	0.10	MKP-684□0305AB127□-Z
	0.82	31	18	9	27.5	0.8	0.10	MKP-824□0305AB127□-Z
	1	31	20	10	27.5	0.8	0.10	MKP-105□0305AB127□-Z
	1.5	31	20.5	12	27.5	0.8	0.10	MKP-155□0305AB127□-Z
	2.2	31	24.5	15	27.5	0.8	0.10	MKP-225□0305AB127□-Z
	3.3	31	33	18	27.5	0.8	0.10	MKP-335□0305AB127□-Z
	4.7	31	37	22	27.5	0.8	0.10	MKP-475□0305AB127□-Z
	3.3	41.5	27.5	16	37.5	1.0	0.10	MKP-335□0305AB137□-Z
	4.7	41.5	31.5	18.5	37.5	1.0	0.10	MKP-475□0305AB137□-Z
	5.6	41.5	35	19	37.5	1.0	0.10	MKP-565M0305AB137□-Z
	5.6	41.5	34	20.5	37.5	1.0	0.10	MKP-565K0305AB137□-Z
	6.8	41.5	35.5	22.5	37.5	1.0	0.10	MKP-685M0305AB137□-Z
	6.8	42	40	20	37.5	1.0	0.10	MKP-685K0305AB137□-Z
	8.2	41.5	38	25	37.5	1.0	0.10	MKP-825□0305AB137□-Z
	10	41.5	38	28	37.5	1.0	0.10	MKP-106M0305AB137□-Z
	10	41.5	41	27.5	37.5	1.0	0.10	MKP-106K0305AB137□-Z

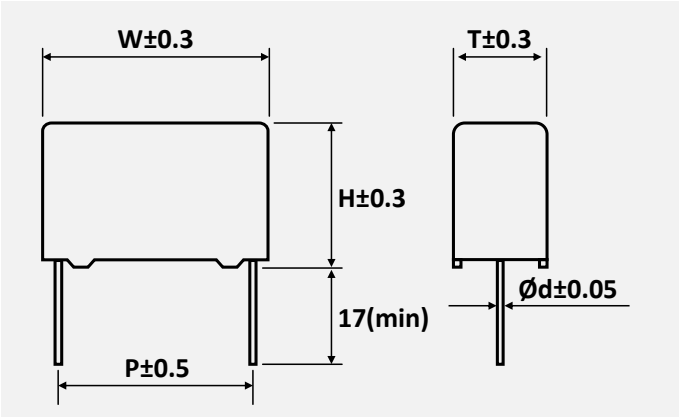
Notes

1 **Measured at 1kHz, 20°C**

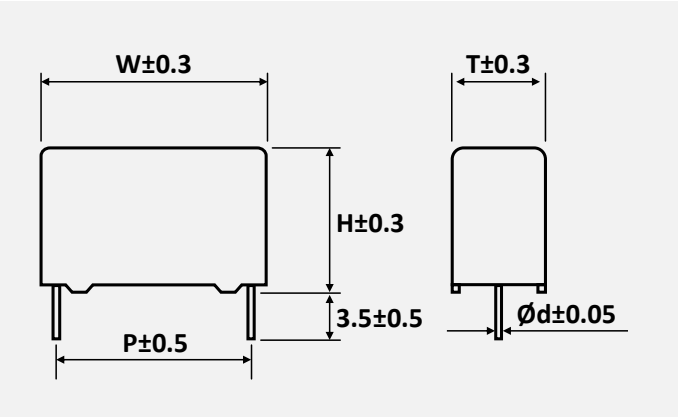
2 **Enter the appropriate tolerance and lead length code □ from the product code table**

PACKAGE OUTLINE ▲ All dimensions in mm

Long Leads



Short Leads



REFERENCE DATA

Fig. 1 ▪ Capacitance Drift vs. Ambient Temperature

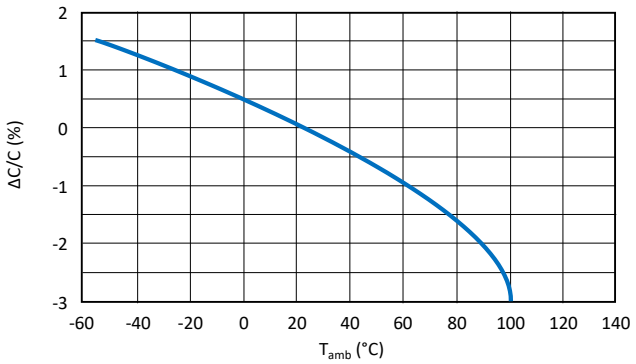


Fig. 2 ▪ Impedance vs. Frequency ▪ $V_{R\,AC}$ = 305V

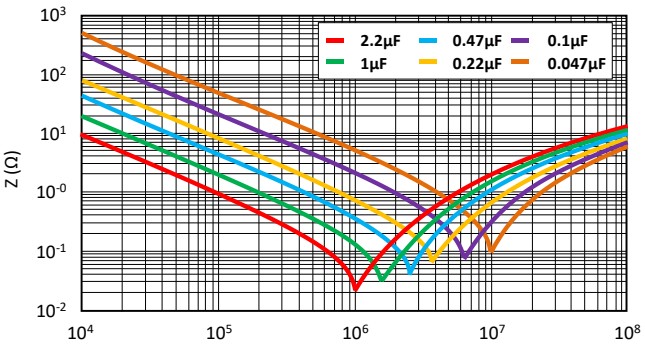
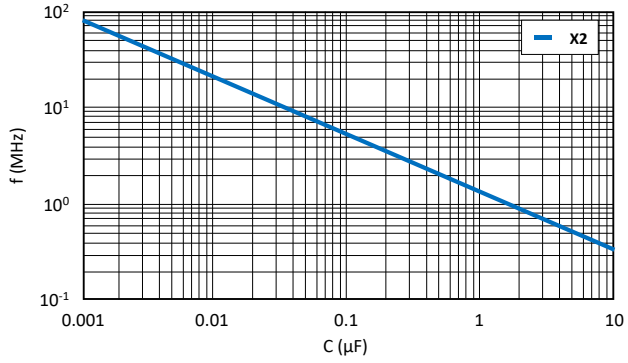


Fig. 3 ▪ Resonant Frequency vs. Capacitance



PRODUCT CODE

Example: MKP-X2-Z **(Voltage divider)** series ▲ 0.01µF ▲ 305V_{AC} ▲ ±10% ▲ P=10mm ▲ Bulk ▲ Straight leads ▲ 17mm lead length

MKP-	103	K	0305	A	B	1	10	1	-Z

Series		Capacitance Code Note 1 (pF)		Capacitance Tolerance (%)		Rated Voltage (V_{AC})		Voltage Type		Packaging Type		Lead Configuration Note 2		Pitch (mm)		Lead Length (mm) Note 3		Special Remark Note 4	
Code	Series	Code	µF	Code	Tol.	Code	VAC	Code	Type	Code	Type	Code	Style	Code	mm	Code	mm	Code	Type
MKP	MKP	103 224 105 155 225 106	0.01 0.22 1.0 1.5 2.2 10	K M	±10 ±20	0305	305	A	AC	B	Bulk	1	SL	10 15 22 27 37	10.0 15.0 22.5 27.5 37.5	1 2	17.0 3.5	-Z	See Note 4

Notes:

1 **Capacitance code expressed in pF. The first two digits represent significant figures. The last digit specifies the total number of zeros to be added.**

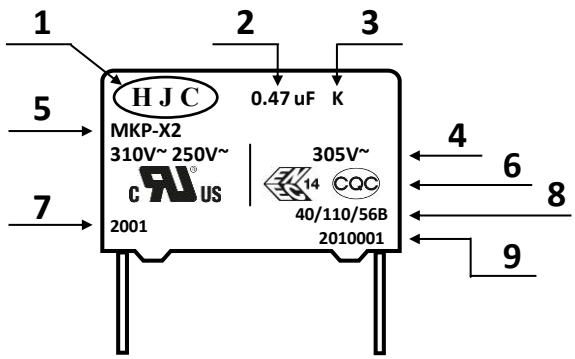
2 **SL = Straight leads, for other lead configuration consult MGT please.**

3 **For other lead length consult MGT please.**

4 **Z = voltage divider (high stability grade)**

PRODUCT MARKING

Marking	Details



No.	Description
1	Manufacturer Logo
2	Nominal capacitance in µF
3	Capacitance tolerance
4	AC rated voltage
5	Series name
6	Safety standard approvals
7	Date code
8	Application category
9	Lot number

DATE CODE & APPLICATION CATEGORY

Example:

Date code

2001: 2001 = 1st week of 2020

Application category

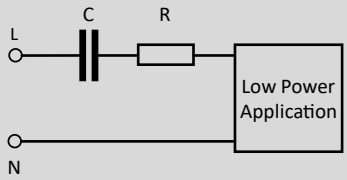
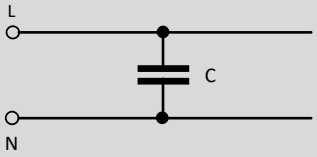
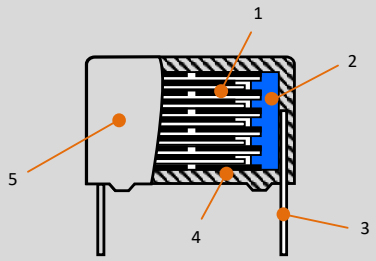
40/110/56B: 40 = Minimum temperature (-40°C)
110 = Maximum temperature (+110°C)
56 = Days of damp heat test
B = Category of passive flammability

Lot number

2010001: 20 = Year, here 2020
1 = Month, here January
0001 to XXXX = Serial number

20		01	
Year		Week	
19	2019	01	1st
20	2020	02	2nd
21	2021	03	3rd
22	2022	04	4th
23	2023	05	5th
...	...	...	...
30	2030	53	53rd

TECHNICAL SPECIFICATION

No.	Category	Specification	
1	Scope	This specification covers the requirement for metallized polypropylene dielectric fixed capacitor. Typical applications: Series impedance, Interference suppression and << across-the-line >> applications Reference standards: IEC60384-14 **Series impedance**  **Across the line**  	
2	Product Name	Metallized polypropylene film capacitor, Type MKP	
3	Product Range	Operating temperature range:	-40°C to +110°C (including temperature rise on unit surface)
		Rated AC voltage (50/60Hz)	$250V_{AC}$ to $310V_{AC}$ ($630V_{DC}$ max.)
		Capacitance range:	Refer to the individual drawing
		Capacitance tolerance:	Refer to the individual drawing
4	Appearance	1. Marking shall be legible in the right place.	
		2. Plating of lead wire shall be perfect without rust.	
		3. Coating shall be without any crack, rent, pinhole etc.	
5	Construction	The capacitor has a non-inductive construction, wound with metallized polypropylene film dielectric. The capacitor is enclosed in flame retardation plastic case, filled with flame retardation filling resin, and has two leads.	
		 	
		1 = Element	Metallized Polypropylene film
		2 = Metal spray	Special solder. (Lead Free) compliant to RoHS directive
		3 = Lead wire	Tinned wire. (Lead Free) compliant to RoHS directive
		4 = Inner coating	Epoxy resin filled. (UL-94V-0 Standard)
		5 = Outer coating	Plastic case. (UL-94V-0 Standard)
6	Dimensions	As specified in the individual drawing.	
7	Conditional Standard Test	The test shall be conducted at a temperature of from 15°C to 35°C, a humidity of from 45% to 75%. However, the test shall be conducted at a temperature of 20±5°C, a humidity of 65±5% when doubt is entertained about judgment.	

TECHNICAL SPECIFICATION

No.	Category	Specification		
8	Character	**Test Item**	**Conditions**	**Performance**
		Voltage proof (IEC60384-14, 4.2.1)	Between terminals Applied voltage: 2000V_{DC} for 3sec Cut-off current: 10mA DC Ramp / rise time: C ≤ 2.2µF: 5sec; 2.2 < C ≤ 10µF: 10sec Between terminals and enclosure Applied voltage: 2050V_{AC} for 1min The capacitor shall be applied the voltage through a resistor of 2kΩ or more when charge and discharge.	Nothing abnormal shall be found.
		Insulation resistance (IEC60384-14, 4.2.5)	Between terminals 15GΩ or more: When C ≤ 0.33µF at 100V_{DC} 5GΩ × µF or more: When C > 0.33µF at 100V_{DC} Between terminals and enclosure 30GΩ or more: at 100V_{DC} 0.5GΩ or more: at 500V_{DC} When the reading of measuring instrument becomes steady at a value after a voltage of 100±15V_{DC} or 500±50V_{DC} is applied for 1 minute ±5 seconds. Ambient temperature at 20°C.	Within the limits stated under conditions.
		Capacitance (IEC60384-14, 4.2.2)	Measured at a frequency of 1 ± 0.2kHz, at 20 °C, 1$V_{RMS.}$	Within a range of specified value
		Dissipation factor (IEC60384-14, 4.2.3)	Measured at a frequency of 1 ± 0.2kHz, at 20 °C, 1$V_{RMS.}$	0.1% or less.
		Termination strength (IEC60384-14, 4.3)	Tensile strength The load specified below shall be applied to the terminal in its draw-out direction gradually up to the specified value and held thus for 10±1se.c Lead wire diameter: Over 0.5 to 0.8 mm Tensile force: 10N Bending strength While the load specified below is applied to the lead wire, the body of the capacitor shall be bent 90° and returned to the original position. This operation shall be conducted in a few seconds. Then the body shall be bent 90°, at the same speed in the opposite direction and returned to the original position. Lead wire diameter: Over 0.5 to 0.8 mm Bending force: 5N	After the test, no breaking or loosening of the terminal shall be found.

TECHNICAL SPECIFICATION

No.	Category	Specification		
8	Character	**Test Item**	**Conditions**	**Performance**
		Vibration proof (IEC60384-14, 4.7)	The frequency shall be varied form from 10Hz to 55Hz at 1.5mm amplitude and back to 10Hz in approximately 1 minute, intervals. This motion shall be applied for a period of 2 hours in each of 3 mutually perpendicular directions. During the last 30 min of vibration in each direction, checks shall be made for open or short-circuiting and interruption.	Bending strength: There shall be no open or short-circuiting and the connections must be stabilized. Appearance: There shall be no such mechanical damage as terminal damage etc.
		Solderability (IEC60384-14, 4.5)	The lead wire shall be immersed into soldering bath at 245±5°C for 2.5±0.5sec up to the depth of 1.5+0.5/-0mm from the bottom of the body.	At least 95% of the circumferential face of lead wire up to immersed level shall be covered with new solder.
		Soldering heat resistance (IEC60384-14, 4.4)	The lead wire shall be immersed into soldering bath and its depth of dipping shall be up to 1.5 +0.5/-0mm from the root of terminals by using a heat shielding plate. Temperature and duration of soldering hall be 350±10°C for 3.5±0.5sec or 260±5°C for 10±1sec. After the immersion is finished, the capacitor shall be let alone at ordinary temperature and humidity for 1±0.5hours.	Appearance: No remarkable change. Withstand voltage: Nothing abnormal shall be found, when a voltage specified in item “voltage- proof” is applied for 1 minute. Insulation resistance: Insulation resistance shall conform to Item “insulation resistance”. Change rate of capacitance: ΔC/C ≤ ± 3% of the value before the test.
		Cold resistance (IEC60384-14, 4.11.4)	The capacitor shall be placed in the testing chamber at -40±3°C for 2+1/-0 hours. After the test, the capacitor shall be let alone at the ordinary condition for 1.5±0.5 hours and shall be satisfied with the performance in the performance column.	Change rate of capacitance: ΔC/C ≤ ± 5% of the value before the test.
		Dry heat resistance (IEC60384-14, 4.11.2)	The capacitor shall be placed in the testing oven at +110±2°C for 2+1/-0 hours. After the test, the capacitor shall be let alone at the ordinary condition for 1.5±0.5 hours and shall be satisfied with the performance in the performance column.	Insulation resistance: ≥ 50% of the initial specified value. Change rate of capacitance: ΔC/C ≤ ± 5% of the value before the test.

TECHNICAL SPECIFICATION

No.	Category	Specification		
		Test Item	**Conditions**	**Performance**
8	**Character**	Damp heat steady state (IEC60384-14, 4.12)	The capacitor under test shall be put in the testing oven and kept at condition of the temperature +40±2°C and the humidity at 90 to 95% for 56 days and then shall be let alone at ordinary condition for 1.5±0.5 hours. After the test, the capacitor shall be satisfied with the performance in the performance column.	Appearance: No remarkable change. Withstand voltage: [between terminals] Nothing abnormal shall be found when a voltage of 1312V_{DC} is applied for 1 minute. [between terminals and enclosure] Nothing abnormal shall be found when a voltage of 2050V_{AC} is applied for 1 minute. Insulation resistance: [between terminals] 7.5GΩ or more (when C ≤0.33μF) at 100V_{DC} 2.5GΩ × μF or more (when C > 0.33μF) at 100V_{DC} [between terminals and enclosure] 15GΩ or more at 100V_{DC} Change rate of capacitance: ΔC/C ≤ ± 5% of the value before the test. Dissipation factor: ≤ 0.15% at 1kHz.
		Damp heat with load	Capacitors shall be subjected the temperature at 40±2°C and relative humidity at 90 to 95% for a period of 1000+24 hours. 240V_{AC} shall be applied to the capacitors under test. It will be measured after removed from the humidity chamber and exposed under room condition for about 2 to 3 hours. After the test, the capacitor shall be satisfied with the performance in the performance column.	Appearance: No remarkable change. Change rate of capacitance: ΔC/C ≤ ±10% of the value before the test. Dissipation factor change: Δtan δ: ≤ 1.0% at 1kHz Insulation resistance: 50% of spec value.

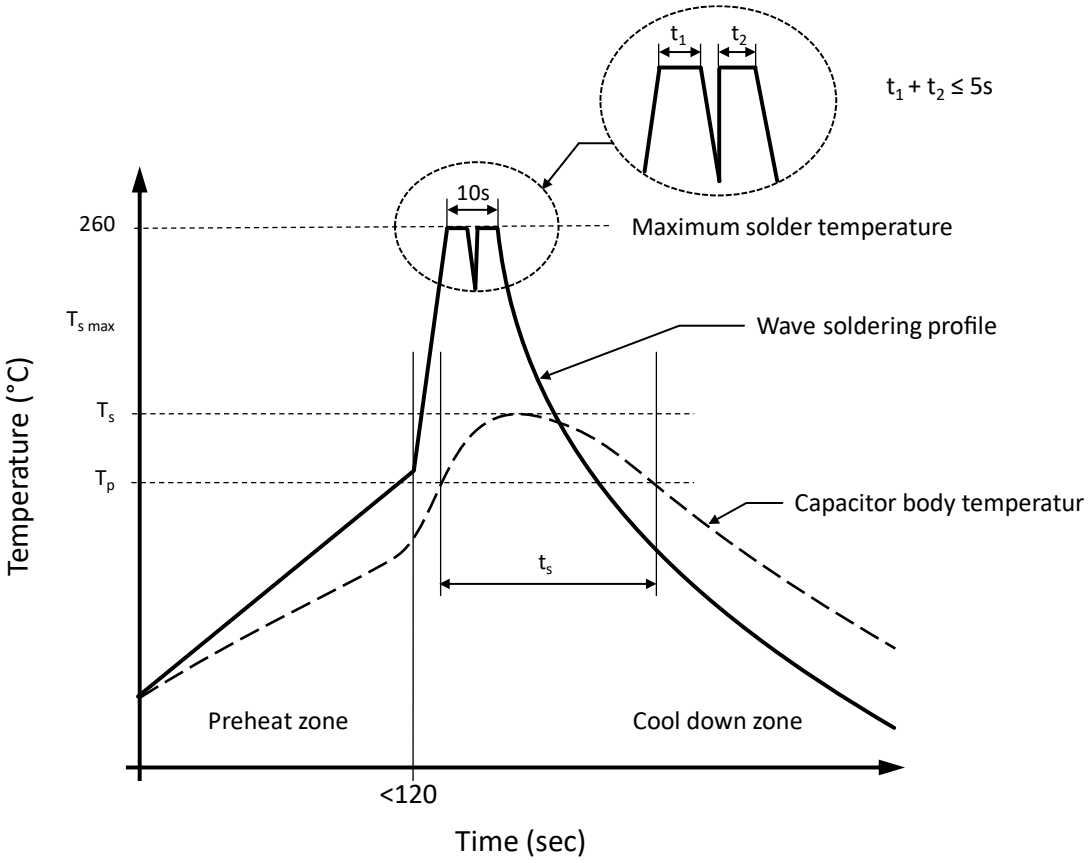
TECHNICAL SPECIFICATION

No.	Category	Specification		
		Test Item	**Conditions**	**Performance**
		Rapid change of temperature (IEC60384-14, 4.6)	The capacitor under the test shall be kept in the testing oven and kept at condition of the temperature of -40±3°C for 30±3 minutes. After this, the capacitor shall be let alone at the ordinary temperature for 3minutes or less. After this, the capacitor under the test shall be kept in the testing oven and kept at condition of the temperature of +110±2°C for 30±3 minutes. Then the capacitor shall be let alone at the ordinary temperature for 3 minutes or less. This operation shall be counted as 1 cycle, and it shall be repeated for 5 cycles successively. After the test, the capacitor shall be let alone at the ordinary condition for 1.5±0.5 hours and shall be satisfied with the performance in the performance column.	Appearance: No remarkable change. Insulation resistance: ≥ 50% of the initial specified value. Change rate of capacitance: ΔC/C ≤ ± 10% of the value before the test. Dissipation factor: ≤ 0.12% at 1kHz.
8	**Character**	Endurance (IEC60384-14, 4.14)	The capacitor shall be submitted to an endurance of 1000h at 110℃ at a 125% of rated voltage and that once every hour the voltage shall be increased to $1000V_{RMS}$ for 0.1 second. After the test, the capacitor shall be satisfied with the following performance.	Appearance: No remarkable change. Withstand voltage: [between terminals] Nothing abnormal shall be found when a voltage of $1312V_{DC}$ is applied for 1 minute. [between terminals and enclosure] Nothing abnormal shall be found when a voltage of $2050V_{AC}$ is applied for 1 minute. Change rate of capacitance: Within ΔC/C ≤ ± 10% of the value before the test. Insulation resistance: [between terminals] 7.5GΩ or more (When C ≤ 0.33μF) at $100V_{DC}$ 2.5GΩ × μF or more (When C > 0.33 μF) at $100V_{DC}$ [between terminals and enclosure] 3GΩ or more at $100V_{DC}$ Dissipation factor: ≤ 0.15% at 1kHz.

TECHNICAL SPECIFICATION

No.	Category	Specification					
9	Approved Standard	**Agency**	**Country**	**Conditions**			**File Number**
		UL	USA	UL60384-14:2014 MKP 0.0047~10.0μF 250~310V_{AC}, 40/110/56/B			E149075-20120803
		ENEC	Semko	EN 60384-14 MKP 0.0047~10.0μF 250~310V_{AC}, 40/110/56/B			SE-ENEC-2002895
		CB	Semko	IEC 60384-14 MKP 0.0047~10.0μF 250~310V_{AC}, 40/110/56/B			SE-103415
		CQC	China	GB/T6346.14-2015 MKP 0.0047~10.0μF 250~310V_{AC}, 40/110/56/B			CQC09001029854
		The **ENEC** mark was accepted in all European countries					
10	Rated Voltage Pulse Slope dV/dt at 630V_{DC}	Pitch	10mm	15mm	22.5mm	27.5mm	37.5mm
		dV/dt	400V/μs	300V/μs	180V/μs	120V/μs	100V/μs
11	Storage Conditions	It should be noted that the solderability of the terminals may be deteriorated when stored barely in an atmosphere for a long period.					
		It should not be in particularly high temperature and high humidity, it must submit to the following conditions (Keeping in the original package) Temperature: 5°C to 35°C Relative humidity: ≤ 70% Storage period: ≤ 12 months (Following the manufacturing date marked on the label in package bag)					
		Avoid wetting the capacitor by water, oil, salt and/or poisonous gas.					
		If used the capacitor that overdue the storage time, it should be test, the characteristics of the capacitor or contact with our technical engineer.					

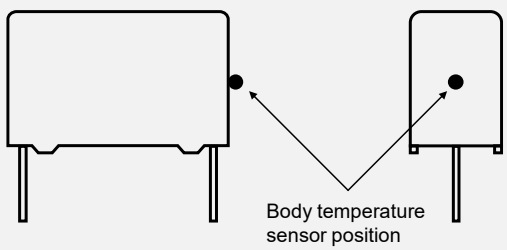
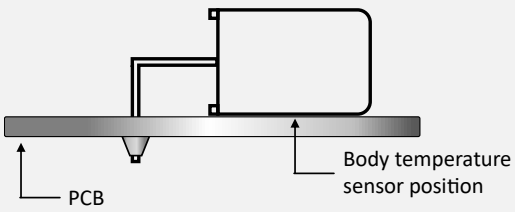
RECOMMENDED WAVE SOLDERING PROFILE ▲ THT PACKAGE



Capacitor body temperature should follow the description below:

Profile Features		Polypropylene Film Capacitor	Polyester Film Capacitor
Capacitor body maximum temperature at preheating	T_P	≤ 110°C / 120 seconds	≤ 125°C / 120 seconds
Capacitor body maximum temperature at wave soldering	T_S	≤ 120°C / t_s ≤ 45 seconds	≤ 150°C / t_s ≤ 45 seconds

DETERMINING THE CAPACITOR BODY TEMPERATURE

Vertical Mounting	Horizontal Mounting
	
The body temperature sensor position is defined as the highest temperature point around the capacitor body.	If there is 90 degree bending product, the sensor position shall between product and PCB

SOLDERING SUGGESTIONS

When solder a capacitor, heat in soldering is conducted to the element of the capacitor from wire lead and an enclosure, and hence it should be noted that soldering under high temperature and a long period may cause deterioration of breakdown of capacitors. Be sure to solder within the recommended temperature condition range.

HAND SOLDERING

a.) Soldering iron top temperature: ≤ 350°C
b.) Soldering time: ≤ 3sec

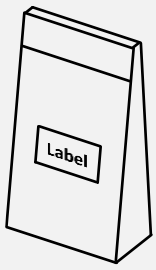
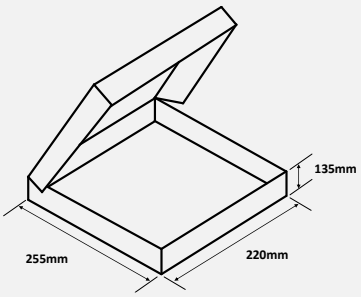
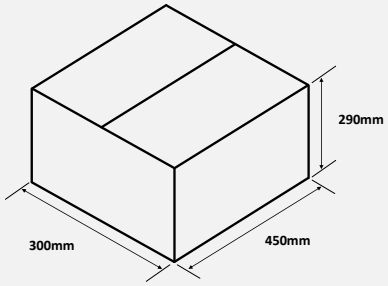
If re-work or dipping twice in necessary, it should be done after the capacitor returned to the normal temperature. Suggestion time is 24 hours.

THT film capacitors are not suitable for reflow soldering.

When SMD components are used together with film capacitor, the film capacitor should not pass into the SMD adhesive curing oven. The film capacitor should be assembled after the SMD process.

To ensure proper conditions for manual or selective soldering, the body (surface) temperature of the film capacitor (T_s) must be ≤ 120°C.

PACKAGING

Bag	Container	Carton
		
Label with 1. Manufacturer name 2. Capacitor type 3. Part number 4. Quantity 5. Package	4 containers per carton	Outside details of the carton 1. Customer name 2. Capacitor type 3. Capacitor specification 4. Part number 5. Quantity

REVISION TABLE

Revision	Date	Status	Notes
001	01/10/2021	Initial release	Initial publication

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