













METALLIZED POLYPROPYLENE CAPACITOR ▲ THT type
Excellent long-term stability under harsh environment
AEC-Q200 on request, contact MGT for more details
Especially for high temperature and high humidity applications
Radio Frequency Interference RFI capacitor ▲ Safety class X2
Temperature Humidity Bias (THB) 500 hours tested

# **SPECIFICATION**

Item		Characteristics			
Related Documents	UL 60384–14:2014, CAN/CSA–E60384–14:2014, IEC60384–14:2013, EN60384–14:2013, GB/T 6346.14–2015				
Rated Temperature Range		-40°C to +110	)°C		
Capacitance Range	$C_R$	0.047μF to 10	)μF		
Capacitance Tolerance	ΔC	±10% ▲ ±20%	6		
Rated Voltage	$V_{RAC}$	305V <sub>AC</sub> (ENEC	C, CQC) ▲ 310V	AC (UL, CUL)	
Insulation Resistance		Terminal to T	erminal	Terminal to Enclosure	
	R <sub>INS</sub>	$\geq 15G\Omega$ at $100V_{DC}$ ( $C_R \leq 0.33\mu F$ )		≥ $30G\Omega$ at $100V_0$	OC .
	11105	$\geq 5G\Omega \times \mu F$ at 10 (C <sub>R</sub> > 0.33 $\mu F$ )	00V <sub>DC</sub>	≥ 0.5GΩ at 500V	DC
Dissipation Factor Note 1	tan δ	0.1% or less			
		Temperature:		85°C	
Reliability Test • 85°C / 85%RH / 500h	Test	Relative Hum	idity:	85%	
Reliability Test - 65 C / 65%RH / 50011	Method	Applied Volta	ige	305V <sub>AC</sub>	
		Duration:		500 hours	
Maximum Pulse Rise Slope	Pitch (mm)	15mm	22.5mm	27.5mm	37.5mm
dV/dt	<b>750V</b> <sub>DC</sub>	300V/μs	180V/μs	120V/μs	100V/μs

Note:

1: Measured at 1kHz, 20±5°C

# **APPLICATIONS**

Capacitive Power Supplies	Industrial	Outdoor Applications	Power Meters	Proximity Sensors	Shutter Controls	White Goods
	0			<b>*</b> (((•		0



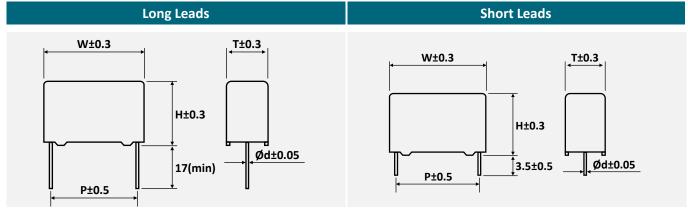
# **ELECTRICAL CHARACTERISTICS**

.,	C <sub>R</sub>		Din	nensions (m	nm)		tanδ	Dood No Note 2
<b>V</b> <sub>R</sub> AC	(μF)	W	Н	T	Р	Ød	(%) Note 1	Part Number Note 2
	0.047	18	12	6	15	0.8	0.10	MKP-473 0305 AB 115 I
	0.068	18	13	7	15	0.8	0.10	MKP-683 0305 AB 115 I
	0.1	18	13.5	7.5	15	0.8	0.10	MKP-104 0305 AB 115 I
	0.15	18	13.5	7.5	15	0.8	0.10	MKP-154_0305AB115_I
	0.22	18	15	9	15	0.8	0.10	MKP-224_0305AB115_I
	0.33	18	18	10	15	0.8	0.10	MKP-334_0305AB115_I
	0.47	18	19	12.5	15	0.8	0.10	MKP-474 0305 AB 115 I
	0.15	26	14.5	6	22.5	0.8	0.10	MKP-154_0305AB122_I
	0.22	26	15	7.5	22.5	0.8	0.10	MKP-224 0305 AB 122 I
	0.33	26	17	8	22.5	0.8	0.10	MKP-334 0305 AB 122 I
	0.47	26	19	10	22.5	0.8	0.10	MKP-474 0305 AB 122 I
	0.56	26	20	10	22.5	0.8	0.10	MKP-564_0305AB122_I
	0.68	26	20	11.5	22.5	0.8	0.10	MKP-684_0305AB122_I
	0.82	26	22	12	22.5	0.8	0.10	MKP-824_0305AB122_I
305V <sub>AC</sub>	1	26	24	13.5	22.5	0.8	0.10	MKP-105 0305 AB 122 I
	0.47	31	18	9	27.5	0.8	0.10	MKP-474 0305 AB 127 I
	0.56	31	20	10	27.5	0.8	0.10	MKP-564_0305AB127_I
	0.68	31	20	10	27.5	0.8	0.10	MKP-684_0305AB127_I
	0.82	31	21	11	27.5	0.8	0.10	MKP-824_0305AB127_I
	1	31	22	13	27.5	0.8	0.10	MKP-105 0305 AB 127 I
	1.5	31	24.5	15	27.5	0.8	0.10	MKP-155 0305 AB 127 I
	2.2	31	28	18	27.5	0.8	0.10	MKP-225 0305 AB 127 I
	3.3	41.5	30	18	37.5	1.0	0.10	MKP-335 0305 AB 137 I
	3.9	41.5	32	20	37.5	1.0	0.10	MKP-395 0305 AB 137 I
	4.7	41.5	35	21	37.5	1.0	0.10	MKP-475 0305 AB 137 I
	5.6	41.5	36	24	37.5	1.0	0.10	MKP-565 0305 AB 137 I
	6.8	41.5	39	26	37.5	1.0	0.10	MKP-685 0305 AB 137 I
	8.2	41.5	41	29	37.5	1.0	0.10	MKP-825 0305 AB 137 I
	10	41.5	45	32	37.5	1.0	0.10	MKP-106 0305 AB 137 I

### 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



MGT 

Manufacturer Group of Technology



# **REFERENCE DATA**

### Fig. 1 • Capacitance Drift vs. Ambient Temperature

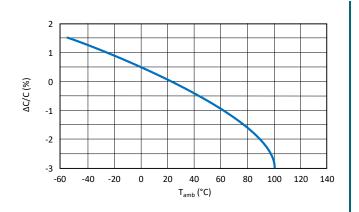


Fig. 2 • Impedance vs. Frequency • V<sub>RAC</sub> = 305V

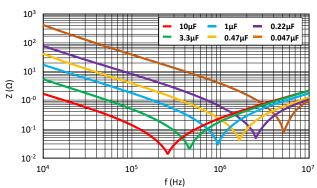
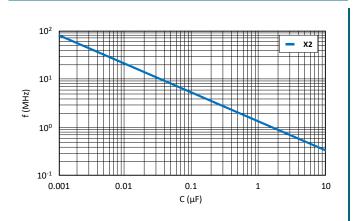


Fig. 3 • Resonant Frequency vs. Capacitance



### **PRODUCT CODE**

Example: MKP-X2-I **(85/85/500h)** series  $\blacktriangle$  1 $\mu$ F  $\blacktriangle$  305V<sub>AC</sub>  $\blacktriangle$  ±10%  $\blacktriangle$  P=27.5mm  $\blacktriangle$  Bulk  $\blacktriangle$  Straight leads  $\blacktriangle$  17mm lead length

М	KP-	10	)5	ŀ	(	03	05	P	<b>\</b>	E	3	1	L	2	7	1	L	ı	
Ser	ries	Capac Code (p	Note 1	Capac Toler (%	ance	Rat Volt (V,	age		age pe		aging pe	Config	ad uration	Pit (m		Length	(mm)		ecial rk <sup>Note 4</sup>
Code	Series	Code	μF	Code	Tol.	Code	VAC	Code	Туре	Code	Туре	Code	Style	Code	mm	Code	mm	Code	Туре
МКР	МКР	473 224 105 395 106	0.047 0.22 1.0 3.9 10.0	K M	±10 ±20	0305	305	А	AC	В	Bulk	1	SL	15 22 27 37	15.0 22.5 27.5 37.5	1 2	17.0 3.5	I	See Note 4

#### Notes:

- 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 I = High temperature & humidity load type. Temperature Humidity Bias (THB) 500 hours tested.

MGT ▲ Manufacturer Group of Technology



# **PRODUCT MARKING**

Marking	Det	ails
	No.	Description
	1	Manufacturer Logo
1 2 3	2	Nominal capacitance in μF
5 HJC 4.7 uF K	3	Capacitance tolerance
MKP-X2 310V~ 250V~ 305V~ 6	4	AC rated voltage
7 C TUS (400) 40/110/56B	5	Series name
THB2001 20100001 9	6	Safety standard approvals
	7	Date code
u U	8	Application category
	9	Lot number

# **DATE CODE & APPLICATION CATEGORY**

Exan	anl	ο.
∟∧aıı	וקו	c.

### Date code

THB2001: THB = THB 1000h tested type

 $2001 = 1^{st}$  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

2	20	C	)1	
Ye	ear	Week		
19	2019	01	1 <sup>st</sup>	
20	2020	02	2 <sup>nd</sup>	
21	2021	03	3 <sup>rd</sup>	
22	2022	04	4 <sup>th</sup>	
23	2023	05	5 <sup>th</sup>	
30	2030	53	53 <sup>rd</sup>	



No.	Category		Specification			
1	Scope	capacitor.	nent for metallized polypropylene dielectric fixed pression and << across-the-line >> applications			
2	Product Name	Metallized polypropylene film capacit	or, 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 <sub>AC</sub> to 310V <sub>AC</sub> (750V <sub>DC</sub> max.)  Capacitance range:  Refer to the individual drawing  Capacitance tolerance:  Refer to the individual drawing				
4	Appearance	<ol> <li>Marking shall be legible in the right place.</li> <li>Plating of lead wire shall be perfect without rust.</li> <li>Coating shall be without any crack, rent, pinhole etc.</li> </ol>				
5	Construction	The capacitor is enclosed in flame retahas two leads.	Metallized Polypropylene film  Metallized Polypropylene film  Special solder. (Lead Free) compliant to RoHS directive  Tinned wire. (Lead Free) compliant to RoHS directive  Epoxy resin filled. (UL-94V-0 Standard)  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.				



No.	Category			Specification		
		Test Item	Conditions		Performance	
			Between terminals			
			Applied voltage	1800V <sub>DC</sub> for 3sec		
			Cut-off current	10mA DC		
			Ramp / rise time	C ≤ 2.2µF: 5sec		
		Voltage proof	Kamp / rise time	$2.2 < C \le 10\mu$ F: 10sec	Nothing abnormal shall be	
		(IEC60384-14, 4.2.1)			found.	
			Between terminals and			
			Applied voltage	2050V <sub>AC</sub> for 1min		
			The capacitor shall be through a resistor of 2 charge and discharge.			
			Between terminals			
			15GΩ or more	When $C \le 0.33 \mu F$ at $100V_{DC}$		
			$5GΩ \times μF$ or more	When C > $0.33\mu$ F at $100V_{DC}$		
		Insulation resistance	Between terminals and enclosure		Within the limits stated under	
		(IEC60384-14, 4.2.5)	$30G\Omega$ or more	at 100V <sub>DC</sub>	conditions.	
			$0.5G\Omega$ or more	at 500V <sub>DC</sub>		
8	Character		When the reading of n becomes steady at a v $100\pm15V_{DC}$ or $500\pm50V_{DC}$ nute $\pm5$ seconds. Ambient temperature	alue after a voltage of / <sub>DC</sub> is applied for 1 mi-		
		Capacitance (IEC60384-14, 4.2.2)	Measured at a frequer at 20 °C, 1V <sub>RMS</sub> .		Within a range of specified value	
		Dissipation factor (IEC60384-14, 4.2.3)	Measured at a frequer at 20 °C, 1V <sub>RMS</sub> .	ncy of 1 ± 0.2kHz,	0.1% or less.	
			Tensile strength			
			The load specified belothe terminal in its drawally up to the specified for 10±1se.c	w-out direction gradu-		
			Lead wire diameter:	Over 0.5 to 0.8 mm		
			Tensile force:	10N		
		Termination	Bending strength		After the test, no breaking or	
		strength	While the load specific	ed below is applied to	loosening of the terminal shall	
		(IEC60384-14, 4.3)	the lead wire, the bod be bent 90° and return tion. This operation sh few seconds. Then the 90°, at the same speed direction and returned tion.	y of the capacitor shall ned to the original posi- all be conducted in a body shall be bent d in the opposite I to the original posi-	be found.	
			Lead wire diameter:	Over 0.5 to 0.8 mm		
			Bending force:	5N		



No.	Category		Specification	
		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.
8	Character	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: $\Delta C/C \le \pm 5\%$ 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.
		Damp heat with load (IEC60384-14,2013/ AMD1:2016)	The 305V <sub>AC</sub> voltage shall be applied continuously to the capacitor at a temperature of 85°C and a relative humidity of 85% for 500 hours and then shall be let alone at ordinary condition for 24 hours.  After the test, the capacitor shall be satisfied with the performance in the performance column.	Appearance: No remarkable change. Change rate of capacitance: $\Delta C/C \le \pm 10\%$ of the value before the test. Dissipation factor change: $\Delta \tan \delta : \le 1.0\%$ at 1kHZ Insulation resistance: 50% of spec value.



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 and enclosure] Nothing abnormal shall be found when a voltage of $2050V_{AC}$ is applied for 1 minute. Insulation resistance: [between terminals] $7.5G\Omega$ or more (when $C \le 0.33\mu F$ ) at $100V_{DC}$ $2.5G\Omega \times \mu F$ or more (when $C > 0.33\mu F$ ) at $100V_{DC}$ [between terminals and enclosure] $15G\Omega$ or more at $100V_{DC}$ Change rate of capacitance: $\Delta C/C \le \pm 5\%$ of the value before the test. Dissipation factor: $\le 0.15\%$ at $1kHz$ .
		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.



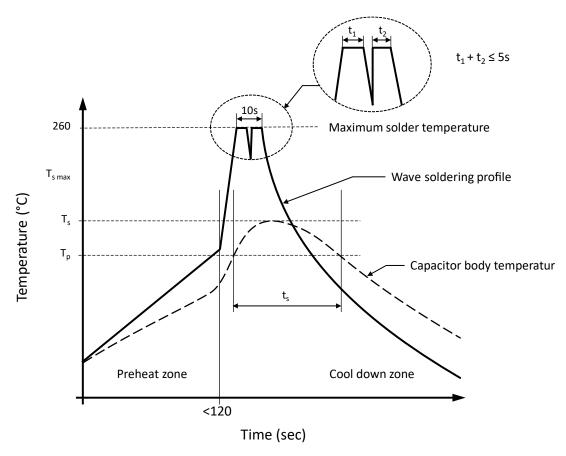
No.	Category		S	specification	
		Test Item	Conditions		Performance
8	Character	Endurance (IEC60384-14, 4.14)	ance of 1000h at 110°C voltage and that once shall be increased to 10 ond. After the test, the capacitor shall be satis performance.	every hour the voltage 000V <sub>RMS</sub> for 0.1 sec- e fied with the following	Appearance: No remarkable change. Withstand voltage: [between terminals] Nothing abnormal shall be found when a voltage of $4.3 \times V_R = 1333V_{DC}$ 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 $\Delta C/C \le \pm 10\%$ of the value before the test. Insulation resistance: [between terminals] $7.5G\Omega$ or more (When $C \le 0.33\mu\text{F}$ ) at $100V_{DC}$ $2.5G\Omega \times \mu\text{F}$ or more (When $C > 0.33\mu\text{F}$ ) at $100V_{DC}$ [between terminals and enclosure] $3G\Omega$ or more at $100V_{DC}$ Dissipation factor: $\le 0.15\%$ at $1\text{kHz}$ .
		Impulse voltage (IEC60384-14, 4.13)	The capacitor shall be a mum of 24 impulses of any three successive in the monitor to have hading that no self-healing curred, then the capac subjected to impulses. Impulse voltage X2 $C \le 1.0 \mu F$	the same polarity. If inpulses are shown by ad a waveform indicat- ty breakdowns have oc- itor shall be no more	Appearance: No remarkable change.  Others: There shall be no permanent breakdown or flashover. After impulse voltage, the capacitor shall be subjected to high temperature loading (item rapid change of temperature).



No.	Category	Specification						
9	Approved Standard	Agency	Country	Conditions			File Number	
		UL	USA	UL60384-14 MKP 0.0047~10.0μF 250~310V <sub>AC</sub> , 40/110/56/B			20181116-E149075	
		CSA	Canada	CAN/CSA-E 60384-14 MKP 0.0047~10.0μF 250~310V <sub>AC</sub> , 40/110/56/B			2294211	
		ENEC	Semko	EN 60384-14 MKP 0.0047~10.0μF 250~310V <sub>AC</sub> , 40/110/56/B			SE-ENEC-2002895	
		СВ	Semko	IEC 60384-14 MKP 0.0047~10.0μF 250~310V <sub>AC</sub> , 40/110/56/B			SE-103415	
		CQC	China	GB/T6346.14-2015 MKP 0.0047~10.0μF 250~310V <sub>AC</sub> , 40/110/56/B			CQC09001029854	
		The <b>ENEC</b>	The <b>ENEC</b> mark was accepted in all European countries					
	Rated Voltage Pulse Slope dV/dt at 750V <sub>DC</sub>	Pitch		15mm	22.5mm	27.5mm	37.5mm	
10		dV/dt		300V/μs	180V/μs	120V/μs	100V/μs	
	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						
11		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.						



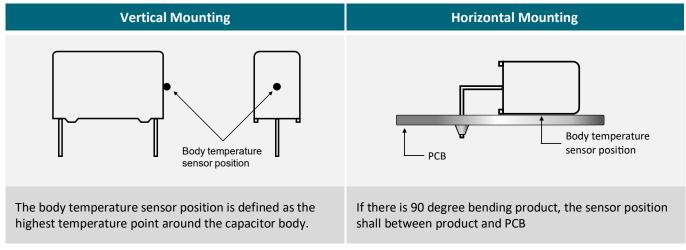
### RECOMMENDED WAVE SOLDERING PROFILE ▲ THT PACKAGE



# Capacitor body temperature should follow the description below:

Profile Features		Polypropylene Film Capacitor	Polyester Film Capacitor
Capacitor body maximum temperature at preheating	T <sub>P</sub>	≤ 110°C / 120 seconds	≤ 125°C / 120 seconds
Capacitor body maximum temperature at wave soldering	Ts	≤ 120°C / t <sub>s</sub> ≤ 45 seconds	≤ 150°C / t <sub>s</sub> ≤ 45 seconds

### **DETERMINING THE CAPACITOR BODY TEMPERATURE**



MGT ▲ Manufacturer Group of Technology



### **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  $\leq 120^{\circ}$ C.

### **PACKAGING**

Bag	Container	Carton	
Label	135mm 220mm	290mm 300mm	
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

#### **DISCLAIMER**

Except for the written expressed warranties, MGT does not implicitly, by assumption or whatever else, warrant, undertake, promise any other warranty or guaranty for any MGT product.

All information and technical specifications made available by MGT are for guidance only and we reserve the right to change or modify them without prior notice. Unless expressly stated in writing by MGT, we reject any guarantees, obligations, or warranties.

All MGT products with the technical specifications described are suitable for use in certain applications. Operating, production, storage and environmental conditions can have a massive influence on the parameters mentioned in the data sheets, which cause the performance to vary over time.

It is subject to the user's duty of care to design and validate his products in such a way that appropriate measures are taken, such as protective circuits or redundant systems to ensure the safety standards required in the application.

MGT components are not designed or rated for use in life support, rescue, safety critical, military, or aerospace applications where failure or malfunction could result in property or environmental damage, serious injury or death. In the aforementioned cases, please contact us before using MGT products.

In principle, we reserve all rights and MGT's general terms and conditions apply. You can find them on our website www.mgt.co.com.