



## SPECIFICATION

- · Supplier : Samsung electro-mechanics
- Product : Multi-layer Ceramic Capacitor
- · Samsung P/N :
- CL10A475KP8NNNC

(Reference sheet)

- Description :
- CAP, 4.7uF, 10V, ±10%, X5R, 0603

A. Samsung Part Number

		CL ①	<u>10</u> ②	<u>▲</u> ③	<u>475</u> ④	<u>K</u> 5	<u>P</u> ©	<u>8</u> 7	<u>N</u> 8	<u>N</u> 9	<u>N</u> 10	<mark>C</mark> (11)	
1	Series	Samsung Multi-layer Ceramic Capacitor											
2	Size	0603 (inch co	ode)		L: ′	1.60	± 0.10	mm			W:	0.80 ± 0.10	mm
3	Dielectric	X5R				8	Inner	elect	rode			Ni	
4	Capacitance	4.7 uF					Term	inatio	n			Cu	
5	Capacitance	±10 %					Platir	g				Sn 100%	(Pb Free)
	tolerance					9	Produ	uct				Normal	
6	Rated Voltage	10 V				10	Speci	al				Reserved fo	r future use
1	Thickness	$0.80 \pm 0.10$ mm				1	Packa	aging				Cardboard T	Type, 7" reel

## **B. Structure & Dimension**



Samsung P/N	Dimension(mm)								
Samsung F/N	L	W	Т	BW					
CL10A475KP8NNNC	1.60 ± 0.10	0.80 ± 0.10	0.80 ± 0.10	0.30 ± 0.20					

## C. Samsung Reliablility Test and Judgement Condition

		Judgement	Test condition				
Tan $\delta$ (DF)0.1 max.treated at 150°C+0/-10°C for 1 hour and maintained ambient air for 24±2 hours.Insulation10,000Mohm or 100Mohm×µ <sup>E</sup> Rated Voltage60~120 sec.ResistanceWhichever is smallerAppearanceMicroscope (×10)WithstandingNo abnormal exterior appearanceMicroscope (×10)WithstandingNo dielectric breakdown or mechanical breakdown250% of the rated voltageTemperatureX5RCharacteristics(From-55°C to 85°C, Capacitance change should be within ±15%)Adhesive Strength Bending StrengthNo peeling shall be occur on the terminal electrodeSolog f, for 10±1 sec.Bending StrengthCapacitance change : is to be soldered newlySinAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. (preheating : 80~120°C for 10~30sec.)Resistance to Vibration TestCapacitance change : Capacitance change : mithin ±12.5%Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : mithin ±12.5MWith rated voltage Mith rated voltageHigh Temperature ResistanceCapacitance change : mithin ±12.5MWith 150% of the rated voltage fran $\delta$ : 0.125 max ir $\delta$ : 0.125 max<	Capacitance	Within specified tolerance	1 <sup>kHz</sup> ±10% / 1.0±0.2Vrms				
Resistance   Whichever is smaller     Appearance   No abnormal exterior appearance   Microscope (×10)     Withstanding   No dielectric breakdown or mechanical breakdown   250% of the rated voltage     Temperature   K5R   Characteristics   (From-55°C to 85°C, Capacitance change should be within ±15%)     Adhesive Strength of Termination   No peeling shall be occur on the terminal electrode   500g·f, for 10±1 sec.     Bending Strength   Capacitance change : within ±12.5%   Bending to the limit (1mm) with 1.0mm/sec.     Solderability   More than 75% of terminal surface is to be soldered newly   Solder pot : 270±5°C, 10±1sec.     Soldering Heat   Tan δ, IR : initial spec.   Solder pot : 270±5°C, 10±1sec.     Vibration Test   Capacitance change : within ±12.5% Tan δ : 0.125 max   Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)     Moisture Resistance   Capacitance change : within ±12.5% Tan δ : 0.125 max   With nated voltage 40±2°C, 90~95%RH, 500+12/-0hrs     High Temperature Resistance   Capacitance change : within ±12.5% Tan δ : 0.125 max   With 150% of the rated voltage Max. operating temperature IR : 1,000Mohm or 25Mohm × μ <sup>E</sup>	Tan δ (DF)	0.1 max.	*A capacitor prior to measuring the capacitance is heat treated at $150^{\circ}C+0/-10^{\circ}C$ for 1 hour and maintained in ambient air for 24±2 hours.				
Appearance   No abnormal exterior appearance   Microscope (×10)     Withstanding   No dielectric breakdown or mechanical breakdown   250% of the rated voltage     Yoltage   mechanical breakdown   250% of the rated voltage     Temperature   X5R   Characteristics   (From-55°C to 85°C, Capacitance change should be within ±15%)     Adhesive Strength of Termination   No peeling shall be occur on the terminal electrode   500g·f, for 10±1 sec.     Bending Strength   Capacitance change : within ±12.5%   Bending to the limit (1mm) with 1.0mm/sec.     Solderability   More than 75% of terminal surface is to be soldered newly   SnAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. (preheating : 80~120°C for 10~30sec.)     Resistance to   Capacitance change : within ±7.5%   Solder pot : 270±5°C, 10±1sec.     Soldering Heat   Tan õ, IR : initial spec.   Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)     Moisture   Capacitance change : within ±12.5% Tan õ : 0.125 max IR : 500Mohm or 12.5Mohm × μ <sup>c</sup> Whichever is smaller   With rated voltage     High Temperature   Capacitance change : within ±12.5% With nated voltage   With 150% of the rated voltage     Resistance   Tan õ : 0.125 max IR : 1,000Mohm or 25Mohm × μ <sup>c</sup> IAn õ : 0.125 max   With 150% of the rated voltage	Insulation	10,000Mohm or 100Mohm× <i>μ</i> F	Rated Voltage 60~120 sec.				
Withstanding No dielectric breakdown or mechanical breakdown 250% of the rated voltage   Voltage mechanical breakdown 250% of the rated voltage   Temperature X5R   Characteristics (From-55°C to 85°C, Capacitance change should be within ±15%)   Adhesive Strength of Termination No peeling shall be occur on the terminal electrode 500g-f, for 10±1 sec.   Bending Strength Capacitance change : within ±12.5% Bending to the limit (1mm) with 1.0mm/sec.   Solderability More than 75% of terminal surface is to be soldered newly SnAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. (preheating : 80~120°C for 10~30sec.)   Resistance to Capacitance change : within ±7.5% Solder pot : 270±5°C, 10±1sec.   Soldering Heat Tan δ, IR : initial spec. Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)   Moisture Capacitance change : within ±12.5% Resistance Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)   Mith rated voltage Tan δ : 0.125 max IR : 500Mohm or 12.5Mohm × μE Whichever is smaller With 150% of the rated voltage Max. operating temperature   High Temperature Resistance Capacitance change : within ±12.5% Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μE With 150% of the rated voltage	Resistance	Whichever is smaller					
Voltagemechanical breakdownTemperature CharacteristicsX5R (From-55°C to 85°C, Capacitance change should be within ±15%)Adhesive Strength of TerminationNo peeling shall be occur on the terminal electrode500g f, for 10±1 sec.Bending Strength of TerminationCapacitance change : within ±12.5%Bending to the limit (1mm) with 1.0mm/sec.SolderabilityMore than 75% of terminal surface is to be soldered newlySnAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. (preheating : 80~120°C for 10~30sec.)Resistance to Soldering HeatCapacitance change : mot, IR : initial spec.within ±7.5% Solder pot : 270±5°C, 10±1sec.Vibration Test ResistanceCapacitance change : mot, IR : initial spec.within ±12.5% Mithin ±12.5% Tan 5, IR : initial spec.More than 712.5Mohm × $\mu^{c}$ With Temperature ResistanceCapacitance change : mothin ± 12.5% Tan 5 : 0.125 max IR : 500Mohm or 12.5Mohm × $\mu^{c}$ With 150% of the rated voltage Max. operating temperature IR : 1,000Mohm or 25Mohm × $\mu^{c}$	Appearance	No abnormal exterior appearance	Microscope (×10)				
Temperature CharacteristicsX5R (From-55 °C to 85 °C, Capacitance change should be within ±15%)Adhesive Strength of TerminationNo peeling shall be occur on the terminal electrode500g·f, for 10±1 sec.Bending StrengthCapacitance change : within ±12.5%Bending to the limit (1mm) with 1.0mm/sec.SolderabilityMore than 75% of terminal surface is to be soldered newlySnAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. (preheating : 80~120°C for 10~30sec.)Resistance to Soldering HeatCapacitance change : tan $\delta_i$ IR : initial spec.Within ±7.5% Solder pot : 270±5°C, 10±1sec.Vibration TestCapacitance change : capacitance change : tan $\delta_i$ IR : initial spec.Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : tan $\delta_i$ 0.125 max IR : Whichever is smallerWith 12.5% Mith ±12.5%With 150% of the rated voltage Max. operating temperature IR : 1,000Mohm or 25Mohm × $\mu^{E}$	Withstanding	No dielectric breakdown or	250% of the rated voltage				
$\begin{array}{l c c c c c c c c c c c c c c c c c c c$	Voltage	mechanical breakdown					
Adhesive Strength of TerminationNo peeling shall be occur on the terminal electrode $500g.f, for 10\pm1 sec.$ Bending StrengthCapacitance change : within ±12.5%Bending to the limit (1mm) with 1.0mm/sec.SolderabilityMore than 75% of terminal surface is to be soldered newlySnAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. 	Temperature	X5R					
of Termination   terminal electrode     Bending Strength   Capacitance change : within ±12.5%   Bending to the limit (1mm) with 1.0mm/sec.     Solderability   More than 75% of terminal surface is to be soldered newly   SnAg3.0Cu0.5 solder 245±5°C, 3±0.3sec. (preheating : 80~120°C for 10~30sec.)     Resistance to   Capacitance change : within ±7.5%   Solder pot : 270±5°C, 10±1sec.     Soldering Heat   Tan ō, IR : initial spec.   Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)     Moisture   Capacitance change : within ±12.5% Tan ō : 0.125 max IR : 500Mohm or 12.5Mohm × μ <sup>F</sup> Whichever is smaller   With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs     High Temperature Resistance   Capacitance change : within ±12.5% Tan ō : 0.125 max IR : 1,000Mohm or 25Mohm × μ <sup>F</sup> With 150% of the rated voltage Max. operating temperature 1000+48/-0hrs	Characteristics	(From-55℃ to 85℃, Capacitance change s	hould be within ±15%)				
Bending StrengthCapacitance change :within $\pm 12.5\%$ Bending to the limit (1mm) with 1.0mm/sec.SolderabilityMore than 75% of terminal surface is to be soldered newlySnAg3.0Cu0.5 solder 245 $\pm$ 5°C, 3 $\pm$ 0.3sec. (preheating : 80~120°C for 10~30sec.)Resistance to Soldering HeatCapacitance change :within $\pm$ 7.5%Solder pot : 270 $\pm$ 5°C, 10 $\pm$ 1sec.Vibration TestCapacitance change :within $\pm$ 5% Tan $\delta$ , IR : initial spec.Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change :within $\pm$ 12.5% Whichever is smallerWith rated voltage 40 $\pm$ 2°C, 90~95%RH, 500+12/-0hrsHigh Temperature ResistanceCapacitance change :within $\pm$ 12.5% Whichever is smallerWith 150% of the rated voltage Max. operating temperature 1000+48/-0hrs	Adhesive Strength	No peeling shall be occur on the	500g⋅f, for 10±1 sec.				
with 1.0mm/sec.SolderabilityMore than 75% of terminal surface is to be soldered newlySnAg3.0Cu0.5 solder $245\pm5^{\circ}$ C, $3\pm0.3$ sec. (preheating : $80\sim120^{\circ}$ C for $10\sim30$ sec.)Resistance to Soldering HeatCapacitance change : Tan $\delta$ , IR : initial spec.within $\pm 7.5\%$ Solder pot : $270\pm5^{\circ}$ C, $10\pm1$ sec.Vibration TestCapacitance change : within $\pm 5\%$ Tan $\delta$ , IR : initial spec.Amplitude : $1.5$ mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : Tan $\delta$ : $0.125$ max IR : $500$ Mohm or $12.5$ Mohm × / $d^{c}$ Whichever is smallerWith $150\%$ of the rated voltage Max. operating temperature 1000+48/-0hrsHigh Temperature ResistanceCapacitance change : $13.00$ within or $25$ Mohm × / $d^{c}$ With $150\%$ of the rated voltage Max. operating temperature $1000+48/-0hrs$	of Termination	terminal electrode					
SolderabilityMore than 75% of terminal surface is to be soldered newlySnAg3.0Cu0.5 solder $245\pm5^{\circ}C$ , $3\pm0.3sec$ . (preheating : $80\sim120^{\circ}C$ for $10\sim30sec$ .)Resistance toCapacitance change : Tan $\delta$ , IR : initial spec.Solder pot : $270\pm5^{\circ}C$ , $10\pm1sec$ .Vibration TestCapacitance change : Capacitance change : Tan $\delta$ , IR : initial spec.Momentum terminal surface (preheating : $80\sim120^{\circ}C$ for $10\sim30sec$ .)MoistureCapacitance change : Capacitance change : Tan $\delta$ , IR : initial spec.Mithin $\pm 5\%$ From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)MoistureCapacitance change : Tan $\delta$ : 0.125 max IR : Whichever is smallerWith rated voltage $40\pm2^{\circ}C$ , $90\sim95\%$ RH, $500+12/-0hrs$ High Temperature ResistanceCapacitance change : within $\pm 12.5\%$ Tan $\delta$ : 0.125 max IR : IR : 1,000Mohm or 25Mohm × / $\mu^{F}$ With 150% Max. operating temperature 1000+48/-0hrs	Bending Strength	Capacitance change : within ±12.5%	Bending to the limit (1mm)				
is to be soldered newly $245\pm5^{\circ}$ C, $3\pm0.3$ sec. (preheating : $80\sim120^{\circ}$ C for $10\sim30$ sec.)Resistance to Soldering HeatCapacitance change : Tan $\delta$ , IR : initial spec.within $\pm7.5\%$ Solder pot : $270\pm5^{\circ}$ C, $10\pm1$ sec.Vibration TestCapacitance change : Dapacitance change : Tan $\delta$ , IR : initial spec.within $\pm 5\%$ From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : N in $\pm 12.5\%$ IR : $500$ Mohm or 12.5Mohm × $\mu^{c}$ With rated voltage $40\pm2^{\circ}$ C, $90\sim95\%$ RH, $500+12/-0$ hrsHigh Temperature ResistanceCapacitance change : N in $\pm 12.5\%$ IR : $0.125$ max IR : $0.125$ max IR : $1,000$ Mohm or 25Mohm × $\mu^{c}$ With $150\%$ of the rated voltage Max. operating temperature $1000+48/-0$ hrs			with 1.0mm/sec.				
Resistance to Soldering HeatCapacitance change : Tan $\delta$ , IR : initial spec.within $\pm 7.5\%$ Solder pot : $270\pm5^{\circ}$ C, $10\pm1$ sec.Vibration TestCapacitance change : Moisture Resistancewithin $\pm 5\%$ Tan $\delta$ , IR : initial spec.Amplitude : $1.5mm$ From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : Michever is smallerwithin $\pm 12.5\%$ Whichever is smallerAmplitude : $1.5mm$ From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)High Temperature ResistanceCapacitance change : Michever is smallerwithin $\pm 12.5\%$ With $\pm 12.5\%$ Tan $\delta$ : $0.125$ max IR : $500$ Mohm or $12.5$ Mohm × $\mu$ F Whichever is smallerWith $150\%$ of the rated voltage Max. operating temperature $1000+48/-0hrs$	Solderability	More than 75% of terminal surface	SnAg3.0Cu0.5 solder				
Resistance to Soldering HeatCapacitance change : Tan $\delta$ , IR : initial spec.within $\pm 7.5\%$ Solder pot : $270\pm5^{\circ}$ C, $10\pm1$ sec.Vibration TestCapacitance change : Tan $\delta$ , IR : initial spec.Within $\pm 5\%$ From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : Tan $\delta$ : 0.125 max IR : 500Mohm or 12.5Mohm × $\mu$ F Whichever is smallerWith rated voltage 40±2°C, 90~95%RH, 500+12/-0hrsHigh Temperature ResistanceCapacitance change : 0.125 max IR : 500Mohm or 25Mohm × $\mu$ FWith 150% of the rated voltage Max. operating temperature 1000+48/-0hrs		is to be soldered newly	245±5℃, 3±0.3sec.				
Soldering HeatTan $\delta$ , IR : initial spec.Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Woisture ResistanceCapacitance change : within ±12.5% Tan $\delta$ : 0.125 max IR : 500Mohm or 12.5Mohm × $\mu$ F Whichever is smallerWith rated voltage 40±2°C, 90~95%RH, 500+12/-0hrsHigh Temperature ResistanceCapacitance change : within ±12.5% Uhichever is smallerWith 150% of the rated voltage Max. operating temperature 1000+48/-0hrs			(preheating : 80~120℃ for 10~30sec.)				
Vibration TestCapacitance change : Tan $\delta$ , IR : initial spec.within $\pm 5\%$ Tan $\delta$ , IR : initial spec.Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : Tan $\delta$ : 0.125 maxwithin $\pm 12.5\%$ 40 $\pm 2^{\circ}$ C, 90~95%RH, 500+12/-0hrsMigh Temperature ResistanceCapacitance change : Whichever is smallerWith $\pm 12.5\%$ With $\pm 12.5\%$ With $150\%$ of the rated voltage Max. operating temperature 1000+48/-0hrs	Resistance to	Capacitance change : within ±7.5%	Solder pot : 270±5°C, 10±1sec.				
Tan $\delta$ , IR : initial spec.From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : within ±12.5% Tan $\delta$ : 0.125 max IR : 500Mohm or 12.5Mohm × $\mu$ F Whichever is smallerWith rated voltage 40±2°C, 90~95%RH, 500+12/-0hrsHigh Temperature ResistanceCapacitance change : within ±12.5% Whichever is smallerWith 150% of the rated voltage Max. operating temperature 1000+48/-0hrs	Soldering Heat						
ResistanceTan $\delta$ :0.125 max $40\pm 2^{\circ}$ C, 90~95%RH, 500+12/-0hrsIR:500Mohm or 12.5Mohm × $\mu$ F $40\pm 2^{\circ}$ C, 90~95%RH, 500+12/-0hrsHigh TemperatureCapacitance change : within $\pm 12.5\%$ With 150% of the rated voltageResistanceTan $\delta$ :0.125 maxMax. operating temperatureIR:1,000Mohm or 25Mohm × $\mu$ F1000+48/-0hrs	Vibration Test		From 10Hz to 55Hz (return : 1min.)				
IR :500Mohm or 12.5Mohm × $\mu$ F Whichever is smallerHigh Temperature ResistanceCapacitance change :within ±12.5% With 150% of the rated voltage Max. operating temperature 1000+48/-0hrs	Moisture	Capacitance change : within ±12.5%					
Whichever is smallerHigh Temperature ResistanceCapacitance change : within $\pm 12.5\%$ Tan $\delta$ : 0.125 max IR : 1,000Mohm or 25Mohm × $\mu$ FWith 150% of the rated voltage Max. operating temperature 1000+48/-0hrs	Resistance	Tan δ : 0.125 max	40±2℃, 90~95%RH, 500+12/-0hrs				
High Temperature ResistanceCapacitance change : $0.125$ maxwithin $\pm 12.5\%$ Max. operating temperatureWith $150\%$ of the rated voltage Max. operating temperature $1000+48/-0hrs$		IR : 500Mohm or 12.5Mohm × $\mu$ F					
ResistanceTan $\delta$ :0.125 maxMax. operating temperatureIR:1,000Mohm or 25Mohm × $\mu$ F1000+48/-0hrs		Whichever is smaller					
Resistance   Tan δ: 0.125 max   Max. operating temperature     IR: 1,000Mohm or 25Mohm × μF   1000+48/-0hrs	High Temperature	Capacitance change : within ±12.5%	With 150% of the rated voltage				
		Tan δ : 0.125 max	-				
Whichever is smaller		IR : 1,000Mohm or 25Mohm × μF	1000+48/-0hrs				
		Whichever is smaller					
Temperature   Capacitance change :   within ±7.5%   1 cycle condition	Temperature	Capacitance change : within ±7.5%	1 cycle condition				
<b>Cycling</b> Tan $\delta$ , IR : initial spec. Min. operating temperature $\rightarrow 25^{\circ}$ C	-	Tan δ, IR : initial spec.	-				
$\rightarrow$ Max. operating temperature $\rightarrow$ 25°C	-						
5 cycle test			5 cycle test				

X The reliability test condition can be replaced by the corresponding accelerated test condition.

## D. Recommended Soldering method :

Reflow ( Reflow Peak Temperature : 260+0/-5°C, 10sec. Max )

Product specifications included in the specifications are effective as of March 1, 2013. Please be advised that they are standard product specifications for reference only. We may change, modify or discontinue the product specifications without notice at any time.

So, you need to approve the product specifications before placing an order.

Should you have any question regarding the product specifications,

please contact our sales personnel or application engineers.