



# **SPECIFICATION**

(Reference sheet)

· Supplier : Samsung electro-mechanics · Samsung P/N : CL21B224KBFNNNG

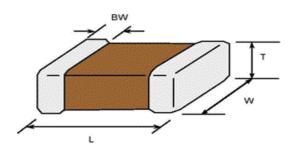
· Product : Multi-layer Ceramic Capacitor · Description : CAP, 220nF, 50V, ±10%, X7R, 0805

### A. Samsung Part Number

<u>CL</u> <u>21</u> <u>B</u> <u>224</u> <u>K</u> <u>B</u> <u>F</u> <u>N</u> <u>N</u> <u>N</u> <u>O</u> ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

1	Series	Samsung Multi-layer Ceramic Capacitor				
2	Size	0805 (inch code)	L: 2.00 ± 0.10	mm W:	1.25 ± 0.10 m	m
3	Dielectric	X7R	8 Inner	electrode	Ni	
4	Capacitance	220 nF	Term	ination	Cu	
(5)	Capacitance	±10 %	Platir	ng	Sn 100%	(Pb Free)
	tolerance		9 Prod	uct	Normal	
6	Rated Voltage	50 V	10 Spec	ial	Reserved for	future use
7	Thickness	$1.25 \pm 0.10 \text{ mm}$	① Pack	aging	Embossed Ty	ype, 7" reel

#### **B. Structure & Dimension**



Samsung P/N	Dimension(mm)				
Samsung F/N	L	W	Т	BW	
CL21B224KBFNNNG	2.00 ± 0.10	1.25 ± 0.10	1.25 ± 0.10	0.50 +0.20/-0.30	

#### C. Samsung Reliablility Test and Judgement Condition

Tan δ (DF)  0.025 max.  *A capacitor prior to measuring the capacitance is heat treated at 150°C+0/-10°C for 1 hour and maintained in ambient air for 24±2 hours.  Rated Voltage 60~120 sec.  Whichever is smaller  Appearance  No abnormal exterior appearance  Microscope (×10)  Withstanding  No dielectric breakdown or mechanical breakdown  Temperature  Characteristics  Adhesive Strength of 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  Soldering Heat  Tan δ, IR: initial spec.  Within ±12.5%  Amplitude: 1.5mm  From 10liz to 56liz (return: 1min.)  Zhours × 3 direction (x, y, z)  Moisture  Resistance  Capacitance change: within ±12.5%  Resistance  Tan δ : 0.05 max  IR: 500Mohm or 25Mohm × μF  Whichever is smaller  Temperature  Resistance  Resistance  Capacitance change: within ±12.5%  With 720% of the rated voltage  Max. operating temperature  Max. operating temperature  Resistance  Tan δ : 0.05 max  IR: 1,000Mohm or 50Mohm × μF  Whichever is smaller  Temperature  Capacitance change: within ±7.5%  Toyloc condition		Judgement	Test condition		
Tan δ (DF)       0.025 max.       treated at 150℃+0/-10℃ for 1 hour and maintained in ambient air for 24±2 hours.         Insulation       10.000Mohm or 500Mohm×μF       Rated Voltage       60~120 sec.         Resistance       Whichever is smaller       Appearance       No abnormal exterior appearance       Microscope (×10)         Withstanding       No dielectric breakdown or wechanical breakdown       250% of the rated voltage         Voltage       mechanical breakdown         Temperature       X7R         Characteristics       (From-55℃ to 125℃, Capacitance change should be within ±15%)         Adhesive Strength       No peeling shall be occur on the 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℃, 32-0.3sec. (preheating : 80~120℃ for 10~30sec.)         Resistance to       Capacitance change : within ±7.5%       Solder pot : 270±5℃, 10±1sec.         Soldering Heat       Tan δ, IR : initial spec.       Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)         Wibration Test       Capacitance change : within ±12.5%       With rated voltage 40±2℃, 90~95%RH, 500+12/-0hrs         Resistance       Tan δ : 0.05 max IR : initial spec.       Within ±12.5%	Capacitance	Within specified tolerance	1kHz ±10% / 1.0±0.2Vrms		
Resistance   Whichever is smaller   Appearance   No abnormal exterior appearance   Microscope (×10)	Tan δ (DF)	0.025 max.	treated at 150 ℃+0/-10 ℃ for 1 hour and maintained in		
Appearance         No abnormal exterior appearance         Microscope (×10)           Withstanding         No dielectric breakdown or mechanical breakdown         250% of the rated voltage           Temperature         X7R           Characteristics         (From-55℃ to 125℃, Capacitance change should be within ±15%)           Adhesive Strength         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℃, 3±0.3sec. (preheating: 80~120℃ for 10~30sec.)           Resistance to         Capacitance change: within ±7.5%         Solder pot: 270±5℃, 10±1sec.           Soldering Heat         Tan δ, IR: initial spec.         Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours × 3 direction (x, y, z)           Wibration Test         Capacitance change: within ±12.5%         With rated voltage 40±2℃, 90~95%RH, 500+12/-0hrs           Resistance         Tan δ: 0.05 max IR: 500Mohm × μF Whichever is smaller         With 200% of the rated voltage Max. operating temperature           High Temperature         Capacitance change: within ±12.5% With 200% of the rated voltage Max. operating temperature         Max. operating temperature           Temperature         Capacitance change: within ±7.5%         1 cycle c	Insulation	10,000Mohm or 500Mohm× <i>μ</i> F	Rated Voltage 60~120 sec.		
Withstanding         No dielectric breakdown or mechanical breakdown         250% of the rated voltage           Temperature         X7R           Characteristics         (From-55 ℃ to 125 ℃, Capacitance change should be within ±15%)           Adhesive Strength         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 10½ to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)           Wibration Test         Capacitance change : within ±12.5%         Amplitude : 1.5mm From 10½ to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)           Moisture         Capacitance change : within ±12.5%         With rated voltage           Resistance         Tan δ : 0.05 max         Within ±12.5%         Within ±12.5%         With 200% of the rated voltage           Max. operating temperature         Max. operating temperature         Max. operating temperature           Temperature         Capacitance change : within ±7.5%         1 cycle conditio					
Voltage         mechanical breakdown           Temperature         X7R           Characteristics         (From-55℃ to 125℃, 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)           Wibration Test         Capacitance change:         within ±12.5%         With rated voltage           Moisture         Capacitance change:         within ±12.5%         With rated voltage           Resistance         Tan δ:         0.05 max         With 200% of the rated voltage           High Temperature         Capacitance change:         within ±12.5%         Wax. operating temperature           Resistance         Tan δ:         0.05 max         Max. operating temperature           Whichever is smaller         Monotherer is s	Appearance No abnormal exterior appearance		Microscope (×10)		
Temperature Characteristics (From-55°C to 125°C, Capacitance change should be within ±15%)  Adhesive Strength of Termination 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  Capacitance change: within ±7.5%  Solder pot: 270±5°C, 10±1sec.  Soldering Heat  Vibration Test  Capacitance change: within ±5%  Tan δ, IR: initial spec.  Capacitance change: within ±12.5%  Tan δ : 0.05 max  IR: 500Mohm or 25Mohm ×  Whichever is smaller  High Temperature  Resistance  Tan δ : 0.05 max  IR: 1,000Mohm or 50Mohm ×  Whichever is smaller  Temperature  Capacitance change: within ±7.5%  With 200% of the rated voltage  Max. operating temperature  Max. operating temperature  Max. operating temperature  Tan δ, IR: initial spec.  Tan δ, IR: initial spec.  Tan δ, IR: initial spec.  Tan δ : 0.05 max  IR: 1,000Mohm or 50Mohm ×  Whichever is smaller  Temperature  Capacitance change: within ±7.5%  With 200% of the rated voltage  Max. operating temperature  1000+48/-0hrs  Min. operating temperature  Temperature  Capacitance change: within ±7.5%  Tan δ, IR: initial spec.	Withstanding	No dielectric breakdown or	250% of the rated voltage		
Temperature Characteristics (From-55°C to 125°C, Capacitance change should be within ±15%)  Adhesive Strength of Termination 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  Capacitance change: within ±7.5%  Solder pot: 270±5°C, 10±1 sec.  (preheating: 80~120°C for 10~30sec.)  Resistance to Capacitance change: within ±7.5% Solder pot: 270±5°C, 10±1 sec.  Soldering Heat Tan δ, IR: initial spec.  Vibration Test Capacitance change: within ±5% Tan δ, IR: initial spec.  Capacitance change: within ±12.5% Tan δ : 0.05 max IR: 500Mohm or 25Mohm ×  Whichever is smaller  High Temperature Resistance Tan δ: 0.05 max IR: 1,000Mohm or 50Mohm ×  Whichever is smaller  Temperature Capacitance change: within ±7.5% With 200% of the rated voltage Max. operating temperature Max. operating temperature 1000+48/-0hrs Whichever is smaller  Temperature Capacitance change: within ±7.5% Tan δ, IR: initial spec.  Vibration Test Tan δ : 0.05 max IR: 1,000Mohm or 50Mohm ×  Whichever is smaller  Temperature Capacitance change: within ±7.5% With 200% of the rated voltage Max. operating temperature 1000+48/-0hrs  Max. operating temperature 1000+48/-0hrs  Whichever is smaller  Temperature Capacitance change: within ±7.5% Tan δ, IR: initial spec.  Tan δ in 125°C	Voltage	mechanical breakdown			
Adhesive Strength of Termination  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  Capacitance change: within ±7.5%  Soldering Heat  Vibration Test  Capacitance change: within ±12.5%  Moisture  Resistance  Capacitance change: within ±12.5%  Tan δ: 0.05 max IR: 500Mohm or 25Mohm × μF Whichever is smaller  High Temperature  Capacitance change: within ±7.5%  Whichever is smaller  Temperature  Capacitance change: within ±7.5%  Tan δ, IR: initial spec.  With 200% of the rated voltage Max. operating temperature Max. operating temperature Capacitance change: within ±7.5%  Whichever is smaller  Temperature Capacitance change: within ±7.5%  Whichever is smaller  Temperature Capacitance change: within ±7.5%  Tan δ, IR: initial spec.  Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours × 3 direction (x, y, z)  With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs  With 200% of the rated voltage Max. operating temperature 1000+48/-0hrs  Whichever is smaller  Temperature Capacitance change: within ±7.5%  Tan δ, IR: initial spec.  Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours × 3 direction (x, y, z)  With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs  Max. operating temperature 1000+48/-0hrs  With 200% of the rated voltage Max. operating temperature 1000+48/-0hrs  Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours × 3 direction (x, y, z)  With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs  1000+48/-0hrs  Max. operating temperature 1000+48/-0hrs		X7R			
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)         Wibration Test       Capacitance change : within ±12.5%       With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs         Resistance       Tan δ : 0.05 max IR : 500Mohm or 25Mohm × μF Whichever is smaller       With 200% of the rated voltage Max. operating temperature         High Temperature       Capacitance change : within ±12.5% Whichever is smaller       Max. operating temperature       Max. operating temperature         Temperature       Capacitance change : within ±7.5% Whichever is smaller       1 cycle condition Min. operating temperature       → 25°C	Characteristics	(From-55℃ to 125℃, Capacitance change s	should be within ±15%)		
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         Vibration Test       Capacitance change : within ±5%       Amplitude : 1.5mm         From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)         Moisture       Capacitance change : within ±12.5%       With rated voltage         Resistance       Tan δ : 0.05 max IR : 500Mohm or 25Mohm × μF Whichever is smaller       With 200% of the rated voltage         High Temperature       Capacitance change : within ±12.5% Whichever is smaller       With 200% of the rated voltage         Tan δ : 0.05 max IR : 1,000Mohm or 50Mohm × μF Whichever is smaller       1000+48/-0hrs         Temperature       Capacitance change : within ±7.5% Whichever is smaller       1 cycle condition         Temperature       Capacitance change : within ±7.5% Min. operating temperature       → 25°C	Adhesive Strength				
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%       With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs         Resistance       Tan δ : 0.05 max IR : 500Mohm or 25Mohm × /μ² Whichever is smaller       With 200% of the rated voltage Max. operating temperature 1000+48/-0hrs         High Temperature       Capacitance change : within ±12.5% Whichever is smaller       With 200% of the rated voltage Max. operating temperature 1000+48/-0hrs         Temperature       Capacitance change : within ±7.5% Whichever is smaller       To cycle condition Min. operating temperature → 25°C	of Termination	terminal electrode			
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%       With rated voltage         Resistance       Tan δ : 0.05 max IR : 500Mohm or 25Mohm × μF       With rated voltage         Whichever is smaller       With 200% of the rated voltage         High Temperature       Capacitance change : within ±12.5%       With 200% of the rated voltage         Resistance       Tan δ : 0.05 max IR : 1,000Mohm or 50Mohm × μF       With 200% of the rated voltage         Max. operating temperature       1000+48/-0hrs         Whichever is smaller       1 cycle condition         Temperature       Capacitance change : within ±7.5%       1 cycle condition         Cycling       Tan δ, IR : initial spec.       Mithin ±7.5%       1 cycle condition         Min. operating temperature       → 25°C	Bending Strength	Capacitance change: within ±12.5%	Bending to the limit (1mm)		
is to be soldered newly   245±5°C, 3±0.3sec. (preheating: 80~120°C for 10~30sec.)			with 1.0mm/sec.		
is to be soldered newly   245±5°C, 3±0.3sec. (preheating: 80~120°C for 10~30sec.)	Solderability	More than 75% of terminal surface	SnAg3.0Cu0.5 solder		
Resistance to Capacitance change : within $\pm 7.5\%$ Solder pot : $270\pm 5^{\circ}$ C, $10\pm 1$ sec.  Soldering Heat Tan $\delta$ , IR : initial spec.  Vibration Test Capacitance change : within $\pm 5\%$ Amplitude : $1.5$ mm From $10$ Hz to $55$ Hz (return : $1$ min.) 2hours $\times 3$ direction (x, y, z)  Moisture Capacitance change : within $\pm 12.5\%$ With rated voltage 40 $\pm 2^{\circ}$ C, $90-95\%$ RH, $500+12$ /-0hrs  IR : $500$ Mohm or $25$ Mohm $\times \mu$ F Whichever is smaller  High Temperature Capacitance change : within $\pm 12.5\%$ With $200\%$ of the rated voltage Max. operating temperature 1000+48/-0hrs  Temperature Capacitance change : within $\pm 7.5\%$		is to be soldered newly	245±5°C, 3±0.3sec.		
Soldering HeatTan δ, IR : initial spec.Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)MoistureCapacitance change : Tan δ : 0.05 maxwithin ±12.5% 40±2°C, 90~95%RH, 500+12/-0hrsHigh TemperatureCapacitance change : Whichever is smallerwithin ±12.5% 40±2°C, 90~95%RH, 500+12/-0hrsHigh TemperatureCapacitance change : With ±12.5%With 200% of the rated voltage Max. operating temperatureResistanceTan δ : Uncompared to 0.05 max IR : Whichever is smallerMax. operating temperature 1000+48/-0hrsTemperatureCapacitance change : Whichever is smaller1 cycle condition Min. operating temperatureTemperatureCapacitance change : Whithial spec.1 cycle condition Min. operating temperature			(preheating : 80~120°C for 10~30sec.)		
Vibration TestCapacitance change : within ± 5% Tan δ, IR : initial spec.Amplitude : 1.5mm From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)MoistureCapacitance change : within ±12.5% Tan δ : 0.05 max IR : 500Mohm or 25Mohm × $\mu$ F Whichever is smallerWith rated voltage 40±2°C, 90~95%RH, 500+12/-0hrsHigh TemperatureCapacitance change : within ±12.5% Whichever is smallerWith 200% of the rated voltage Max. operating temperature 1000+48/-0hrsResistanceTan δ : 0.05 max Whichever is smallerMax. operating temperature 1000+48/-0hrsTemperatureCapacitance change : within ±7.5% Whichever is smaller1 cycle condition Min. operating temperatureTemperatureCapacitance change : within ±7.5% Min. operating temperature1 cycle condition Min. operating temperature	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  Resistance  Tan $\delta$ : 0.05 max  IR: 500Mohm or 25Mohm × $\mu$ F  Whichever is smaller  High Temperature  Resistance  Tan $\delta$ : 0.05 max  IR: 500Mohm or 25Mohm × $\mu$ F  Whichever is smaller  High Temperature  Resistance  Tan $\delta$ : 0.05 max  IR: 1,000Mohm or 50Mohm × $\mu$ F  Whichever is smaller  Temperature  Capacitance change: within $\pm 12.5\%$ With 200% of the rated voltage  Max. operating temperature  1000+48/-0hrs  Temperature  Capacitance change: within $\pm 7.5\%$ Temperature  Capacitance change: within $\pm 7.5\%$ Toycle condition  Min. operating temperature $\rightarrow$ 25°C	Soldering Heat				
Resistance       Tan δ : 0.05 max $40\pm2^{\circ}$ C, $90\sim95\%$ RH, $500\pm12/-0$ hrs         IR : 500Mohm or 25Mohm × μF       Whichever is smaller         High Temperature       Capacitance change : within ±12.5%       With 200% of the rated voltage         Resistance       Tan δ : 0.05 max       Max. operating temperature         IR : 1,000Mohm or 50Mohm × μF       1000+48/-0hrs         Whichever is smaller       1 cycle condition         Temperature       Capacitance change : within ±7.5%       1 cycle condition         Cycling       Tan δ, IR : initial spec.       Min. operating temperature       → 25°C	Vibration Test	, ,	From 10Hz to 55Hz (return : 1min.)		
IR: 500Mohm or 25Mohm × $\mu$ F    Whichever is smaller  High Temperature Resistance  Tan δ: 0.05 max IR: 1,000Mohm or 50Mohm × $\mu$ F    Whichever is smaller  Temperature Capacitance change: within ±7.5% With 200% of the rated voltage Max. operating temperature 1000+48/-0hrs  Temperature Capacitance change: within ±7.5% Tan δ, IR: initial spec.  1 cycle condition Min. operating temperature $\rightarrow$ 25°C	Moisture	Capacitance change: within ±12.5%	With rated voltage		
Whichever is smallerHigh Temperature ResistanceCapacitance change : within $\pm 12.5\%$ Tan $\delta$ : 0.05 max IR : 1,000Mohm or 50Mohm × $\mu$ F Whichever is smallerWith $200\%$ of the rated voltage Max. operating temperature 1000+48/-0hrsTemperature CyclingCapacitance change : within $\pm 7.5\%$ Tan $\delta$ , IR : initial spec.1 cycle condition Min. operating temperature	Resistance	Tan δ: 0.05 max	40±2°C, 90~95%RH, 500+12/-0hrs		
High Temperature ResistanceCapacitance change : within $\pm 12.5\%$ Tan $\delta$ : 0.05 max IR : 1,000Mohm or 50Mohm × $\mu$ F Whichever is smallerWith 200% of the rated voltage Max. operating temperature 1000+48/-0hrsTemperature CyclingCapacitance change : within $\pm 7.5\%$ Tan $\delta$ , IR : initial spec.1 cycle condition Min. operating temperature		IR: 500Mohm or 25Mohm × $\mu$ F			
Resistance       Tan δ : 0.05 max       Max. operating temperature         IR : 1,000Mohm or 50Mohm × $\mu$ F       1000+48/-0hrs         Whichever is smaller       1 cycle condition         Cycling       Tan δ, IR : initial spec.       Min. operating temperature         Max. operating temperature       1000+48/-0hrs         1 cycle condition       1 cycle condition         Min. operating temperature       → 25°C		Whichever is smaller			
IR: 1,000Mohm or 50Mohm × $\mu$ F Whichever is smaller  Temperature Capacitance change: within ±7.5% 1 cycle condition Tan δ, IR: initial spec. 1 cycle condition Min. operating temperature $\rightarrow$ 25°C	High Temperature	Capacitance change: within ±12.5%	With 200% of the rated voltage		
	Resistance	Tan δ: 0.05 max	Max. operating temperature		
Temperature       Capacitance change : within $\pm 7.5\%$ 1 cycle condition         Cycling       Tan δ, IR : initial spec.       Min. operating temperature $\rightarrow$ 25°C		IR: 1,000Mohm or 50Mohm × $\mu$ F	1000+48/-0hrs		
Cycling    Tan δ, IR : initial spec.    Min. operating temperature    → 25°C		Whichever is smaller			
	Temperature	Capacitance change: within ±7.5%	1 cycle condition		
→ Max. operating temperature → 25°C	Cycling	Tan δ, IR : initial spec.	Min. operating temperature → 25°C		
			→ Max. operating temperature → 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 )



A 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.

# - Disclaimer & Limitation of Use and Application -

The products listed in this Specification sheet are **NOT** designed and manufactured for any use and applications set forth below.

Please note that any misuse of the products deviating from products specifications or information provided in this Spec sheet may cause serious property damages or personal injury.

We will **NOT** be liable for any damages resulting from any misuse of the products, specifically including using the products for high reliability applications as listed below.

If you have any questions regarding this 'Limitation of Use and Application', you should first contact our sales personnel or application engineers.

- ① Aerospace/Aviation equipment
- ② Automotive or Transportation equipment (vehicles, trains, ships, etc)
- 3 Medical equipment
- Military equipment
- 5 Disaster prevention/crime prevention equipment
- Any other applications with the same as or similar complexity or reliability to the applications set forth above.