



# **SPECIFICATION**

(Reference sheet)

· Supplier : Samsung electro-mechanics · Samsung P/N : CL10A225KO8NFNC

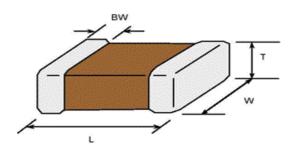
· Product : Multi-layer Ceramic Capacitor · Description : CAP, 2.2uF, 16V, ±10%, X5R, 0603

### A. Samsung Part Number

<u>CL</u> <u>10</u> <u>A</u> <u>225</u> <u>K</u> <u>O</u> <u>8</u> <u>N</u> <u>F</u> <u>N</u> <u>C</u> 1 2 3 4 5 6 7 8 9 10 11

1	Series	Samsung Multi-layer Ceramic Capacitor				
2	Size	0603 (inch code)	L: 1.60	± 0.10 mm	W:	$0.80 \pm 0.10 \text{ mm}$
3	Dielectric	X5R	8	Inner electrode		Ni
4	Capacitance	2.2 uF		Termination		Cu
5	Capacitance	±10 %		Plating		Sn 100% (Pb Free)
	tolerance		9	Product		Product for POWER application
6	Rated Voltage	16 V	10	Special		Reserved for future use
7	Thickness	$0.80 \pm 0.10 \text{ mm}$	11)	Packaging		Cardboard Type, 7" reel

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



Sameung D/N	Dimension(mm)					
Samsung P/N	L	W	Т	BW		
CL10A225KO8NFNC	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 δ (DF)  0.1 max. treated at 150 ℃+0/-10 ℃ for 1 hour and maintained is ambient air for 24±2 hours.  Resistance  Whichever is smaller  Appearance  No abnormal exterior appearance  Microscope (×10)  Withstanding  No dielectric breakdown or mechanical breakdown  Temperature  Characteristics  (From-55 ℃ to 85 ℃, Capacitance change should be within ±15%)  Adhesive Strength of Termination  Bending Strength  of Termination  Bending Strength  More than 75% of terminal surface is to be soldered newly  with 1.0mm/sec.  Solderability  More than 75% of terminal surface  is to be soldered newly  Wibration Test  Capacitance change : within ±7.5%  Soldering Heat  Vibration Test  Capacitance change : within ±5%  Tan δ, IR : initial spec.  Within ±12.5%  Moisture  Capacitance change : within ±12.5%  Resistance  Tan δ : 0.125 max  IR : 500Mohm or 12.5Mohm ×  Whichever is smaller  Whichever is smaller  Whichever is smaller  Tan δ : 0.125 max  IR : 1,000Mohm or 25Mohm ×  Whichever is smaller  Tan δ : 0.125 max  IR : 1,000Mohm or 25Mohm ×  Whichever is smaller  Tan δ : 0.125 max  IR : 1,000Mohm or 25Mohm ×  Whichever is smaller  Tan δ : 0.125 max  IR : 1,000Mohm or 25Mohm ×  Whichever is smaller	Capacitance	Within specified tolerance	1 kHz ±10% / 1.0±0.2Vrms		
Resistance Whichever is smaller  Appearance No abnormal exterior appearance Microscope (×10)  Withstanding No dielectric breakdown or 250% of the rated voltage  Woltage mechanical breakdown  Temperature X5R  Characteristics (From-55°C to 85°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 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.  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 : 0.125 max IR : 500Mohm or 12.5Mohm × μF Whichever is smaller  High Temperature Capacitance change : within ±12.5% Max. operating temperature Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Max. operating temperature Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Max. operating temperature Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Max. operating temperature Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Max. operating temperature Tan δ : 0.125 max Max. operating temperature T	Tan δ (DF)	0.1 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.		
Appearance         No abnormal exterior appearance         Microscope (×10)           Withstanding         No dielectric breakdown or mechanical breakdown         250% of the rated voltage           Temperature         X5R           Characteristics         (From-55°C to 85°C, 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         SnAg3.0Cu.0.5 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           Trom 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)           Moisture         Capacitance change : within ±12.5%         With rated voltage           Resistance         Tan δ : 0.125 max         Whichever is smaller           High Temperature         Capacitance change : within ±12.5%         With 150% of the rated voltage           Max. operating temperature         Tan δ : 0.125 max	Insulation	10,000Mohm or 100Mohm× <i>µ</i> F	Rated Voltage 60~120 sec.		
Withstanding       No dielectric 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         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 Soldering Heat       Capacitance change: within ±7.5%       Solder pot: 270±5°C, 10±1sec.         Soldering Heat Tan δ, IR: initial spec.       Within ±5%       Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours × 3 direction (x, y, z)         Moisture Capacitance change: Tan δ: 0.125 max IR: 500Mohm or 12.5Mohm × μF Whichever is smaller       With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs         High Temperature Resistance       Capacitance change: within ±12.5% With 150% of the rated voltage Max. operating temperature 1,000+48/-0hrs         Whichever is smaller       Max. operating temperature 1,000+48/-0hrs	Resistance	Whichever is smaller			
Voltage         mechanical breakdown           Temperature Characteristics         X5R           Adhesive Strength of Termination         No peeling shall be occur on the terminal electrode         500g·f, for 10±1 sec.           Bending Strength of Termination         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 Soldering Heat         Capacitance change: within ±7.5%         Solder pot: 270±5°C, 10±1sec.           Soldering Heat Tan δ, IR: initial spec.         Capacitance change: within ±5%         Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours × 3 direction (x, y, z)           Moisture Resistance         Capacitance change: within ±12.5%         With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs           High Temperature Resistance         Capacitance change: within ±12.5%         With 150% of the rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs           High Temperature Resistance         Capacitance change: within ±12.5%         With 150% of the rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs           Whichever is smaller         Max. operating temperature 1,000+48/-0hrs	Appearance	No abnormal exterior appearance	Microscope (×10)		
Temperature Characteristics  Adhesive Strength of Termination  Bending Strength  Of Lapacitance change: within ±12.5%  More than 75% of terminal surface is to be soldered newly  With 1.0mm/sec.  Solderability  More than 75% of terminal surface is to be soldered newly  Resistance to  Soldering Heat  Vibration Test  Capacitance change: within ±12.5%  Moisture  Resistance  Tan δ, IR: initial spec.  Capacitance change: within ±12.5%  Moisture  Resistance  Tan δ : 0.125 max IR: 500Mohm or 12.5Mohm × μF  Whichever is smaller  Max. operating temperature  Resistance  Tan δ : 0.125 max IR: 1,000Mohm or 25Mohm × μF  Whichever is smaller	Withstanding	No dielectric breakdown or	250% of the rated voltage		
Characteristics         (From-55 ℃ to 85 ℃, 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: 0.125 max IR: 500Mohm or 12.5Mohm × μF         Within ±12.5%         With 150% of the rated voltage           High Temperature         Capacitance change: within ±12.5%         With 150% of the rated voltage           Resistance         Tan δ: 0.125 max IR: 1,000Mohm or 25Mohm × μF         With 150% of the rated voltage           Whichever is smaller         Max. operating temperature         1,000+48/-0hrs	Voltage	mechanical breakdown			
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         Moisture       Capacitance change : within ±12.5% With rated voltage 40±2°C, 90~95%RH, 500+12/-0hrs         Resistance       Tan δ : 0.125 max IR : 500Mohm or 12.5Mohm × μF Whichever is smaller       With 150% of the rated voltage Max. operating temperature 1,000+48/-0hrs         High Temperature       Capacitance change : within ±12.5% Whichever is smaller       With 150% of the rated voltage Max. operating temperature 1,000+48/-0hrs	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 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 : 0.125 max IR : 500Mohm or 12.5Mohm × μF Whichever is smaller         With 150% of the rated voltage Max. operating temperature           High Temperature         Capacitance change : within ±12.5%         With 150% of the rated voltage Max. operating temperature           Resistance         Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Whichever is smaller         With 150% of the rated voltage Max. operating temperature	Characteristics	(From-55℃ to 85℃, Capacitance change sl	hould 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 From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)         Moisture       Capacitance change : within ±12.5%       With rated voltage         Resistance       Tan δ : 0.125 max IR : 500Mohm or 12.5Mohm × μF Whichever is smaller       With 150% of the rated voltage         High Temperature       Capacitance change : within ±12.5%       With 150% of the rated voltage         Resistance       Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Whichever is smaller       Max. operating temperature         High Temperature       Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × μF Whichever is smaller       Max. operating temperature	Adhesive Strength	No peeling shall be occur on the	500g·f, for 10±1 sec.		
	of Termination	terminal electrode			
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 $\delta$ , IR : initial spec.Within $\pm 7.5\%$ Solder pot : $270\pm5$ °C, $10\pm1$ sec.Vibration TestCapacitance change : Tan $\delta$ , IR : initial spec.Amplitude : $1.5$ mm From 10Hz to $55$ Hz (return : $1$ min.) 2hours × 3 direction (x, y, z)Moisture ResistanceCapacitance change : Tan $\delta$ : $0.125$ max Whichever is smallerWith rated voltage 40±2°C, $90\sim95\%$ RH, $500+12/-0$ hrsHigh Temperature ResistanceCapacitance change : Within $\pm 12.5\%$ Whichever is smallerWith $150\%$ of the rated voltage Max. operating temperature 1,000+48/-0hrsHigh Temperature ResistanceTan $\delta$ : $0.125$ max Whichever is smallerWith $150\%$ of the rated voltage Max. operating temperature 1,000+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 \text{sec.} \\  \text{(preheating: } 80\sim120^{\circ}C \text{ for } 10\sim30 \text{sec.}) $ $ \text{Resistance to} \qquad \text{Capacitance change:} \qquad \text{within } \pm7.5\% \qquad \text{Solder pot: } 270\pm5^{\circ}C, 10\pm1 \text{sec.} $ $ \text{Soldering Heat} \qquad \text{Tan } \delta, \text{ IR: initial spec.} \qquad \text{Within } \pm5\% \qquad \text{Amplitude: } 1.5 \text{mm} $ $ \text{Tan } \delta, \text{ IR: initial spec.} \qquad \text{From } 10 \text{Hz to } 55 \text{Hz (return: } 1 \text{min.}) $ $ 2 \text{hours } \times 3 \text{ direction } (x, y, z) $ $ \text{Moisture} \qquad \text{Capacitance change:} \qquad \text{within } \pm12.5\% \qquad \text{With rated voltage} $ $ \text{Resistance} \qquad \text{Tan } \delta:  0.125 \text{ max} \qquad \text{He} $ $ \text{Whichever is smaller} $ $ \text{High Temperature} \qquad \text{Capacitance change:} \qquad \text{within } \pm12.5\% \qquad \text{With } 150\%  \text{of the rated voltage} $ $ \text{Max. operating temperature} $ $ \text{Resistance} \qquad \text{Tan } \delta:  0.125 \text{ max} \qquad \text{He} $ $ \text{IR:} \qquad 1,000 \text{Mohm or } 25 \text{Mohm} \times \mu\text{F} $ $ \text{Whichever is smaller} $ $ \text{Max. operating temperature} $ $ \text{1,000+48/-0hrs} $ $ \text{Whichever is smaller} $			with 1.0mm/sec.		
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.   Capacitance change :   within $\pm 5\%$   Amplitude : $1.5$ mm   From $10$ Hz to $55$ Hz (return : $1$ min.)   2hours × $3$ direction (x, y, z)   Moisture   Capacitance change :   within $\pm 12.5\%$   With rated voltage   40 $\pm 2^{\circ}$ C, $90\sim 95\%$ RH, $500+12/-0$ hrs   Resistance   Tan $\delta$ : $0.125$ max   IR : $500$ Mohm or $12.5$ Mohm × $\mu$ F   Whichever is smaller   With $150\%$   of the rated voltage   Max. operating temperature   Tan $\delta$ : $0.125$ max   IR : $1,000$ Mohm or $25$ Mohm × $\mu$ F   Whichever is smaller   1,000+48/-0hrs	Solderability	More than 75% of terminal surface	SnAg3.0Cu0.5 solder		
Resistance to Soldering Heat Tan $\delta$ , IR: initial spec.  Vibration Test Capacitance change: within $\pm 5\%$ Amplitude: 1.5mm From 10Hz to 55Hz (return: 1min.) 2hours $\times$ 3 direction (x, y, z)  Moisture Capacitance change: within $\pm 12.5\%$ With rated voltage Tan $\delta$ : 0.125 max IR: 500Mohm or 12.5Mohm $\times \mu F$ Whichever is smaller  High Temperature Resistance Tan $\delta$ : 0.125 max IR: 1,000Mohm or 25Mohm $\times \mu F$ Whichever is smaller  Capacitance change: within $\pm 12.5\%$ With $\pm 12.5\%$ With $\pm 12.5\%$ With $\pm 12.5\%$ With $\pm 12.5\%$ Of the rated voltage Max. operating temperature 1,000+48/-0hrs		is to be soldered newly	245±5°C, 3±0.3sec.		
Soldering HeatTan $\delta$ , IR : initial spec.Amplitude : 1.5mmVibration TestCapacitance change : within $\pm$ 5%Amplitude : 1.5mmTan $\delta$ , IR : initial spec.From 10Hz to 55Hz (return : 1min.) 2hours $\times$ 3 direction (x, y, z)MoistureCapacitance change : within $\pm$ 12.5%With rated voltageResistanceTan $\delta$ : 0.125 max $40\pm2^{\circ}$ C, $90\sim95^{\circ}$ RH, $500+12^{\prime}$ -0hrsIR : 500Mohm or 12.5Mohm $\times \mu$ F Whichever is smallerWith $150^{\circ}$ of the rated voltageHigh TemperatureCapacitance change : within $\pm$ 12.5%With $150^{\circ}$ of the rated voltageResistanceTan $\delta$ : 0.125 maxMax. operating temperatureIR : 1,000Mohm or 25Mohm $\times \mu$ F Whichever is smaller1,000+48/-0hrs			(preheating : 80~120°C for 10~30sec.)		
Vibration TestCapacitance change : Tan δ, IR : initial spec.within ± 5% From 10Hz to 55Hz (return : 1min.) 2hours × 3 direction (x, y, z)MoistureCapacitance change : Tan δ : Whichever is smallerWith rated voltage 40±2°C, 90~95%RH, 500+12/-0hrsHigh TemperatureCapacitance change : Whichever is smallerWith 150% Max. operating temperature 1,000+48/-0hrsResistanceTan δ : 1,000Mohm or 25Mohm × $\mu$ F Whichever is smallerWith 150% Max. operating temperature 1,000+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  Resistance  Capacitance change: within ±12.5%  Tan $\delta$ : 0.125 max  IR: 500Mohm or 12.5Mohm × $\mu$ F  Whichever is smaller  High Temperature  Resistance  Capacitance change: within ±12.5%  Tan $\delta$ : 0.125 max  IR: 1,000Mohm or 25Mohm × $\mu$ F  Whichever is smaller  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 150% of the rated voltage  Max. operating temperature  1,000+48/-0hrs  Whichever is smaller	Soldering Heat	Tan δ, IR : initial spec.			
ResistanceTan δ : 0.125 max IR : 500Mohm or 12.5Mohm × $\mu$ F Whichever is smaller $40\pm2^{\circ}$ C, $90\sim95\%$ RH, $500+12/-0$ hrsHigh Temperature ResistanceCapacitance change : within $\pm12.5\%$ Tan δ : 0.125 max IR : 1,000Mohm or 25Mohm × $\mu$ F Whichever is smallerWith 150% of the rated voltage Max. operating temperature 1,000+48/-0hrs	Vibration Test	j '	From 10Hz to 55Hz (return : 1min.)		
IR : 500Mohm or 12.5Mohm × $\mu$ F   Whichever is smaller	Moisture	Capacitance change: within ±12.5%	With rated voltage		
	Resistance	Tan δ: 0.125 max	40±2℃, 90~95%RH, 500+12/-0hrs		
Resistance Tan δ : 0.125 max Max. operating temperature 1,000+48/-0hrs Whichever is smaller					
ResistanceTan δ : 0.125 maxMax. operating temperatureIR : 1,000Mohm or 25Mohm × $μ$ F1,000+48/-0hrsWhichever is smaller	High Temperature	Capacitance change: within ±12.5%	With 150% of the rated voltage		
Whichever is smaller	Resistance	Tan δ: 0.125 max	Max. operating temperature		
Temperature Capacitance change: within ±7.5% 1 cycle condition			1,000+48/-0hrs		
	Temperature	Capacitance change: within ±7.5%	1 cycle condition		
Cycling       Tan δ, IR : initial spec.       Min. operating temperature $\rightarrow$ 25°C	Cycling	Tan δ, IR : initial spec.	Min. operating temperature → 25°C		
→ Max. operating temperature → 25°C			→ Max. operating temperature → 25°C		
5 cycle test			5 cycle test		

<sup>\*\*</sup> The reliability test condition can be replaced by the corresponding accelerated test condition.

### D. Recommended Soldering method:

Reflow ( Reflow Peak Temperature : 260±5°C, 30sec. )



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
- 4 Military equipment
- ⑤ Disaster prevention/crime prevention equipment
- 6 Power plant control equipment
- Atomic energy-related equipment
- Undersea equipment
- Traffic signal equipment
- Data-processing equipment
- ## Electric heating apparatus, burning equipment
- Safety equipment
- ® Any other applications with the same as or similar complexity or reliability to the applications