

# Specification of Automotive MLCC

- Supplier : Samsung electro-mechanics
- Product : Multi-layer Ceramic Capacitor

- Samsung P/N : **CL21B222KC65PNC**
- Description : **CAP, 2.2nF, 100V, ±10%, X7R, 0805**
- AEC-Q 200 Specified

## A. Samsung Part Number

CL   21   B   222   K   C   6   5   P   N   C  
 ①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧   ⑨   ⑩   ⑪

① <b>Series</b>	Samsung Multi-layer Ceramic Capacitor		
② <b>Size</b>	0805 (inch code)	L: 2.0 ± 0.1 mm	W: 1.25 ± 0.1 mm
③ <b>Dielectric</b>	X7R	⑧ <b>Inner electrode</b>	Ni , Open mode
④ <b>Capacitance</b>	2.2 nF	<b>Termination</b>	Cu , Ag-epoxy
⑤ <b>Capacitance tolerance</b>	±10 %	<b>Plating</b>	Sn 100% (Pb Free)
⑥ <b>Rated Voltage</b>	100 V	⑨ <b>Product</b>	Automotive
⑦ <b>Thickness</b>	0.6 ± 0.1 mm	⑩ <b>Grade code</b>	Standard
		⑪ <b>Packaging</b>	Cardboard Type, 7" reel

## B. Reliability Test and Judgement condition

	Performance	Test condition
<b>High Temperature Exposure</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within ±10% Tan δ : 0.03 max IR : More than 10,000MΩ or 500MΩ×μF Whichever is Smaller	Unpowered, 1000hrs@T=150°C Measurement at 24±2hrs after test conclusion
<b>Temperature Cycling</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within ±10% Tan δ : 0.03 max IR : More than 10,000MΩ or 500MΩ×μF Whichever is Smaller	1000Cycles Measurement at 24±2hrs after test conclusion 1 cycle condition : -55+0/-3°C (15±3min) -> Room Temp(1min.) -> 125+3/-0°C (15±3min) -> Room Temp(1min.)
<b>Destructive Physical Analysis</b>	No Defects or abnormalities	Per EIA 469
<b>Moisture Resistance</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within ±12.5% Tan δ : 0.03 max IR : More than 10,000MΩ or 500MΩ×μF Whichever is Smaller	10Cycles, t=24hrs/cycle Heat (25~65°C) and humidity (80~98%), Unpowered measurement at 24±2hrs after test conclusion
<b>Humidity Bias</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within ±12.5% Tan δ : 0.035 max IR : More than 500MΩ or 25MΩ×μF Whichever is Smaller	1000hrs 85°C/85%RH, Rated Voltate and 1.3~1.5V, Add 100kohm resistor Measurement at 24±2hrs after test conclusion The charge/discharge current is less than 50mA.
<b>High Temperature Operating Life</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within ±12.5% Tan δ : 0.035 max IR : More than 1000MΩ or 50MΩ×μF Whichever is Smaller	1000hrs @ TA=125°C, 200% Rated Voltage, Measurement at 24±2hrs after test conclusion The charge/discharge current is less than 50mA.

	Performance	Test condition								
<b>External Visual</b>	No abnormal exterior appearance	Microscope ( $\times 10$ )								
<b>Physical Dimensions</b>	Within the specified dimensions	Using The calipers								
<b>Mechanical Shock</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$ Tan $\delta$ , IR : initial spec.	Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks) <table border="1"> <thead> <tr> <th>Peakvalue</th> <th>Duration</th> <th>Wave</th> <th>Velocity</th> </tr> </thead> <tbody> <tr> <td>1,500G</td> <td>0.5ms</td> <td>Half sine</td> <td>4.7m/sec.</td> </tr> </tbody> </table>	Peakvalue	Duration	Wave	Velocity	1,500G	0.5ms	Half sine	4.7m/sec.
Peakvalue	Duration	Wave	Velocity							
1,500G	0.5ms	Half sine	4.7m/sec.							
<b>Vibration</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$ Tan $\delta$ , IR : initial spec.	5g's for 20min., 12cycles each of 3 orientations, Use 8"x5" PCB 0.031" Thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10~2000Hz.								
<b>Resistance to Solder Heat</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$ Tan $\delta$ , IR : initial spec.	Solder pot : $260\pm 5^{\circ}\text{C}$ , $10\pm 1\text{sec}$ .								
<b>Thermal Shock</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$ Tan $\delta$ , IR : initial spec.	$-55^{\circ}\text{C}/+125^{\circ}\text{C}$ . Note: Number of cycles required-300, Maximum transfer time-20 sec, Dwell time-15min. Air-Air								
<b>ESD</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$ Tan $\delta$ , IR : initial spec.	AEC-Q200-002								
<b>Solderability</b>	95% of the terminations is to be soldered evenly and continuously	a) Preheat at $155^{\circ}\text{C}$ for 4 hours, Immerse in solder for 5s at $245\pm 5^{\circ}\text{C}$ b) Steam aging for 8 hours, Immerse in solder for 5s at $245\pm 5^{\circ}\text{C}$ c) Steam aging for 8 hours, Immerse in solder for 120s at $260\pm 5^{\circ}\text{C}$ solder : a solution ethanol and rosin								
<b>Electrical Characterization</b>	Capacitance : Within specified tolerance Tan $\delta$ (DF) : 0.025 max. IR( $25^{\circ}\text{C}$ ) : More than $10,000\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$ IR( $125^{\circ}\text{C}$ ) : More than $1,000\text{M}\Omega$ or $10\text{M}\Omega \times \mu\text{F}$ Whichever is Smaller Dielectric Strength	The Capacitance /D.F. should be measured at $25^{\circ}\text{C}$ , $1\text{kHz} \pm 10\%$ , $1.0 \pm 0.2\text{Vrms}$ I.R. should be measured with a DC voltage not exceeding Rated Voltage @ $25^{\circ}\text{C}$ , @ $125^{\circ}\text{C}$ for 60~120 sec. Dielectric Strength : 250% of the rated voltage for 1~5 seconds								
<b>Board Flex</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$	Bending to the limit (2mm) for 5 seconds								
<b>Terminal Strength(SMD)</b>	Appearance : No abnormal exterior appearance Capacitance Change : Within $\pm 10\%$	18N, for $60 \pm 1$ sec.								
<b>Beam Load</b>	Destruction value should not be exceed Chip Length < 2.5mm a) Chip Thickness > 0.5mm : 20N b) Chip Thickness $\leq$ 0.5mm : 8N	Beam speed $0.5 \pm 0.05\text{mm}/\text{sec}$								
<b>Temperature Characterisitcs</b>	X7R (From $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ , Capacitance change should be within $\pm 15\%$ )									

### C. Recommended Soldering method :

Reflow ( Reflow Peak Temperature :  $260+0/-5^{\circ}\text{C}$ , 10sec. Max )

Meet IPC/JEDEC J-STD-020 D Standard

\* For the more detail Specification, Please refer to the Samsung MLCC catalogue.