

# Specification of Automotive MLCC

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

- Samsung P/N : **CL21B223KB65PNC**
- Description : **CAP, 22nF, 50V, ±10%, X7R, 0805**
- AEC-Q 200 Specified

## A. Samsung Part Number

CL   21   B   223   K   B   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>           | 22 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>         | 50 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<br>Capacitance Change : Within ±10%<br>Tan δ : 0.03 max<br>IR : More than 10,000MΩ or 500MΩ×μF<br>Whichever is Smaller   | Unpowered, 1000hrs@T=150°C<br>Measurement at 24±2hrs after test conclusion   |
| <b>Temperature Cycling</b>             | Appearance : No abnormal exterior appearance<br>Capacitance Change : Within ±10%<br>Tan δ : 0.03 max<br>IR : More than 10,000MΩ or 500MΩ×μF<br>Whichever is Smaller   | 1000Cycles<br>Measurement at 24±2hrs after test conclusion<br>1 cycle condition :<br>-55+0/-3°C (15±3min) -> Room Temp(1min.)<br>-> 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<br>Capacitance Change : Within ±12.5%<br>Tan δ : 0.03 max<br>IR : More than 10,000MΩ or 500MΩ×μF<br>Whichever is Smaller | 10Cycles, t=24hrs/cycle<br>Heat (25~65°C) and humidity (80~98%), Unpowered<br>measurement at 24±2hrs after test conclusion   |
| <b>Humidity Bias</b>                   | Appearance : No abnormal exterior appearance<br>Capacitance Change : Within ±12.5%<br>Tan δ : 0.035 max<br>IR : More than 500MΩ or 25MΩ×μF<br>Whichever is Smaller    | 1000hrs 85°C/85%RH, Rated Voltate and 1.3~1.5V,<br>Add 100kohm resistor<br>Measurement at 24±2hrs after test conclusion<br>The charge/discharge current is less than 50mA.   |
| <b>High Temperature Operating Life</b> | Appearance : No abnormal exterior appearance<br>Capacitance Change : Within ±12.5%<br>Tan δ : 0.035 max<br>IR : More than 1000MΩ or 50MΩ×μF<br>Whichever is Smaller   | 1000hrs @ TA=125°C, 200% Rated Voltage,<br>Measurement at 24±2hrs after test conclusion<br>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<br>Capacitance Change : Within $\pm 10\%$<br>Tan $\delta$ , IR : initial spec.  | Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks)<br><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<br>Capacitance Change : Within $\pm 10\%$<br>Tan $\delta$ , IR : initial spec.  | 5g's for 20min., 12cycles each of 3 orientations,<br>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<br>Capacitance Change : Within $\pm 10\%$<br>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<br>Capacitance Change : Within $\pm 10\%$<br>Tan $\delta$ , IR : initial spec.  | $-55^{\circ}\text{C}/+125^{\circ}\text{C}$ .<br>Note: Number of cycles required-300,<br>Maximum transfer time-20 sec, Dwell time-15min. Air-Air  |           |          |      |          |        |       |           |           |
| <b>ESD</b>                         | Appearance : No abnormal exterior appearance<br>Capacitance Change : Within $\pm 10\%$<br>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 $245\pm 5^{\circ}\text{C}$<br>b) Steam aging for 8 hours, Immerse in solder for 5s at $245\pm 5^{\circ}\text{C}$<br>c) Steam aging for 8 hours, Immerse in solder for 120s at $260\pm 5^{\circ}\text{C}$<br>solder : a solution ethanol and rosin                         |           |          |      |          |        |       |           |           |
| <b>Electrical Characterization</b> | Capacitance : Within specified tolerance<br>Tan $\delta$ (DF) : 0.025 max.<br>IR( $25^{\circ}\text{C}$ ) : More than $10,000\text{M}\Omega$ or $500\text{M}\Omega \times \mu\text{F}$<br>IR( $125^{\circ}\text{C}$ ) : More than $1,000\text{M}\Omega$ or $10\text{M}\Omega \times \mu\text{F}$<br>Whichever is Smaller<br>Dielectric Strength | The Capacitance /D.F. should be measured at $25^{\circ}\text{C}$ ,<br>$1\text{kHz} \pm 10\%$ , $1.0 \pm 0.2\text{Vrms}$<br>I.R. should be measured with a DC voltage not exceeding<br>Rated Voltage @ $25^{\circ}\text{C}$ , @ $125^{\circ}\text{C}$ for 60~120 sec.<br>Dielectric Strength : 250% of the rated voltage for 1~5 seconds                |           |          |      |          |        |       |           |           |
| <b>Board Flex</b>                  | Appearance : No abnormal exterior appearance<br>Capacitance Change : Within $\pm 10\%$   | Bending to the limit (2mm) for 5 seconds   |           |          |      |          |        |       |           |           |
| <b>Terminal Strength(SMD)</b>      | Appearance : No abnormal exterior appearance<br>Capacitance Change : Within $\pm 10\%$   | 18N, for $60 \pm 1$ sec.   |           |          |      |          |        |       |           |           |
| <b>Beam Load</b>                   | Destruction value should not be exceed<br>Chip Length < 2.5mm<br>a) Chip Thickness > 0.5mm : 20N<br>b) Chip Thickness $\leq$ 0.5mm : 8N  | Beam speed<br>$0.5 \pm 0.05\text{mm}/\text{sec}$   |           |          |      |          |        |       |           |           |
| <b>Temperature Characterisitcs</b> | X7R<br>(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.