

# Specification of Automotive MLCC

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

- Samsung P/N : **CL21C471JBC1PNC**
- Description : **CAP, 470pF, 50V, ±5%, COG, 0805**
- AEC-Q 200 Specified

## A. Samsung Part Number

CL   21   C   471   J   B   C   1   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>	COG	⑧ <b>Inner electrode Termination</b>	Ni Cu
④ <b>Capacitance</b>	470 pF	⑨ <b>Plating</b>	Sn 100% (Pb Free)
⑤ <b>Capacitance tolerance</b>	±5 %	⑩ <b>Product</b>	Automotive
⑥ <b>Rated Voltage</b>	50 V	⑪ <b>Grade code</b>	Standard
⑦ <b>Thickness</b>	0.85 ± 0.1 mm		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 ±2.5% or ±0.25pF whichever is larger Q : 1000 min 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 ±2.5% or ±0.25pF whichever is larger Q : 1000 min 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 ±2.5% or ±0.25pF whichever is larger Q : 350 min 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 ±2.5% or ±0.25pF whichever is larger Q : 200 min 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 ±3.0% or ±0.3pF whichever is larger Q : 350 min IR : More than 10,000MΩ or 500MΩ×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 $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger Q, 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 $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger Q, 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 $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger Q, 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 $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger Q, 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 $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger Q, 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 Q : 1000 max. IR( $25^\circ\text{C}$ ) : More than $100,000\text{M}\Omega$ or $1,000\text{M}\Omega \times \mu\text{F}$ IR( $125^\circ\text{C}$ ) : More than $10,000\text{M}\Omega$ or $100\text{M}\Omega \times \mu\text{F}$ Whichever is Smaller Dielectric Strength	The Capacitance /Q should be measured at $25^\circ\text{C}$ , $1\text{MHz} \pm 10\%$ , $0.5\sim 5\text{Vrms}$ 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 $\pm 5.0\%$ or $\pm 0.5\text{pF}$ whichever is larger	Bending to the limit (3mm) for 5 seconds								
<b>Terminal Strength(SMD)</b>	Appearance : No abnormal exterior appearance Capacitance Change : within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger	18N, for $60\pm 1\text{sec}$ .								
<b>Beam Load</b>	Destruction value should not be exceed Chip Length < 2.5mm a) Chip Thickness > 0.5mm : 20N b) Chip Thickness $\leq 0.5\text{mm}$ : 8N	Beam speed $0.5\pm 0.05\text{mm/sec}$								
<b>Temperature Characterisitcs</b>	C0G (From $-55^\circ\text{C}$ to $125^\circ\text{C}$ , Capacitance change should be within $\pm 30\text{PPM}/^\circ\text{C}$ )									

### 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.