

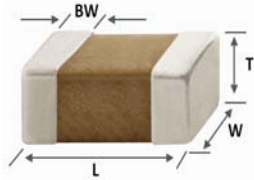
Specification of Automotive MLCC (Reference sheet)

- Supplier : Samsung Electro-Mechanics
- Product : Multi-layer Ceramic Capacitor

- Samsung P/N : **CL05B102KA5VPNC**
- Description : **CAP, 1nF, 25V, ± 10%, X7R, 0402**
- AEC-Q200 Qualified

A. Dimension

● Dimension



| Size | 0402 inch |
|------|--------------|
| L | 1.00±0.05 mm |
| W | 0.50±0.05 mm |
| T | 0.50±0.05 mm |
| BW | 0.25±0.10 mm |

B. Samsung Part Number

CL **05** **B** **102** **K** **A** **5** **V** **P** **N** **C**
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

| | | | |
|-------------------------|---------------------------------------|-------------------|-------------------------|
| ① Series | Samsung Multi-layer Ceramic Capacitor | | |
| ② Size | 0402 (inch code) | L : 1.00±0.05 mm | W : 0.50±0.05 mm |
| ③ Dielectric | X7R | ⑧ Inner electrode | Ni |
| ④ Capacitance | 1 nF | Termination | Metal-Epoxy |
| ⑤ Capacitance tolerance | ± 10% | Plating | Sn 100% (Pb Free) |
| ⑥ Rated Voltage | 25 V | ⑨ Product | Automotive |
| ⑦ Thickness | 0.50±0.05 mm | ⑩ Special code | Normal |
| | | ⑪ Packaging | Cardboard Type, 7" Reel |

C. Reliability Test and Judgement condition

| Test items | Performance | Test condition |
|---------------------------------|--|--|
| High Temperature Exposure | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % Tan δ : 0.03 max. IR : More than 10,000 MΩ or 500 MΩ × μF Whichever is smaller | Unpowered, 1,000hrs @ Max. temperature Measurement at 24±2hrs after test conclusion Initial Measurement 2* Final Measurement 3* |
| Temperature Cycling | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % Tan δ : 0.03 max. IR : More than 10,000 MΩ or 500 MΩ × μF Whichever is smaller | 1,000Cycles Initial Measurement 2* Final Measurement 3* Measurement at 24±2hrs after test conclusion 1 cycle condition : -55+0/-3℃(30±3min) → Room Temp. (1min) → 125+3/-0℃(30±3min) → Room Temp. (1min) |
| Destructive Physical Analysis | No Defects or abnormalities | Per EIA 469 |
| Humidity Bias | Appearance : No abnormal exterior appearance Capacitance Change Within ±12.5 % Tan δ : 0.035 max. IR : More than 500 MΩ or 25 MΩ × μF Whichever is smaller | 1,000hrs 85℃/85%RH, Rated Voltage and 1.3~1.5V, Add 100kohm resistor Initial Measurement 2* Final Measurement 4* Measurement at 24±2hrs after test conclusion The charge/discharge current is less than 50mA. |
| High Temperature Operating Life | Appearance : No abnormal exterior appearance Capacitance Change Within ±12.5 % Tan δ : 0.035 max. IR : More than 1,000 MΩ or 50 MΩ × μF Whichever is smaller | 1,000hrs @ 125℃, 200% Rated Voltage, Initial Measurement 2* Final Measurement 4* Measurement at 24±2hrs after test conclusion The charge/discharge current is less than 50mA. |

| | Performance | Test condition | | | | | | | | |
|-----------------------------|--|---|------------|----------|------|----------|--------|-------|-----------|----------|
| External Visual | No abnormal exterior appearance | Microscope (×10) | | | | | | | | |
| Physical Dimension | Within the specified dimensions | Using The calipers | | | | | | | | |
| Mechanical Shock | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % Tan δ, 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>Peak value</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> Initial Measurement 2* Final Measurement 5* | Peak value | Duration | Wave | Velocity | 1,500G | 0.5ms | Half sine | 4.7m/sec |
| Peak value | Duration | Wave | Velocity | | | | | | | |
| 1,500G | 0.5ms | Half sine | 4.7m/sec | | | | | | | |
| Vibration | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % Tan δ, IR : Initial spec. | 5g's for 20min., 12cycles each of 3 orientations, Use 8"×5" 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 10~2,000Hz. Initial Measurement 2* Final Measurement 5* | | | | | | | | |
| Resistance to Solder Heat | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % Tan δ, IR : Initial spec. | preheating : 150°C for 60~120 sec. Solder pot : 260±5°C, 10±1sec. Initial Measurement 2* Final Measurement 3* | | | | | | | | |
| ESD | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % Tan δ, IR : Initial spec. | AEC-Q200-002 or ISO/DIS10605 Initial Measurement 2* Final Measurement 4* | | | | | | | | |
| Solderability | 95% of the terminations is to be soldered evenly and continuously | a) Preheat at 155°C for 4 hours, Immerse in solder for 5s at 245±5°C b) Steam aging for 8 hours, Immerse in solder for 5s at 245±5°C c) Steam aging for 8 hours, Immerse in solder for 120s at 260±5°C solder : a solution ethanol and rosin | | | | | | | | |
| Electrical Characterization | Capacitance : Within specified tolerance Tan δ : 0.025 max. IR(25°C) : More than 10,000 MΩ or 500 MΩ×μF Whichever is smaller IR(125°C) More than 1,000 MΩ or 10 MΩ×μF Whichever is smaller Dielectric Strength | *A capacitor prior to measuring the capacitance is heat treated at 150 +0/-10°C for 1hour and maintained in ambient air for 24±2 hours The Capacitance / D.F. should be measured at 25°C, 1 kHz ± 10%, 1 ± 0.2 Vrms I.R. should be measured with a DC voltage not exceeding Rated Voltage @25°C, @125°C for 60~120 sec. Dielectric Strength : 250% of the rated voltage for 1~5 seconds | | | | | | | | |
| Board Flex | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % | Bending to the limit, 3 mm for 60 seconds 1* Initial Measurement 2* Final Measurement 5* | | | | | | | | |
| Terminal Strength(SMD) | Appearance : No abnormal exterior appearance Capacitance Change Within ±10 % | 2 N, for 60 sec. Initial Measurement 2* Final Measurement 5* | | | | | | | | |
| Beam Load | Destruction value should be exceed 8 N | Beam speed : 0.5±0.05 mm/sec | | | | | | | | |
| Temperature Characteristics | X7R From -55 °C to 125 °C, Capacitance change should be within ±15% | | | | | | | | | |

D. Recommended Soldering method :

Reflow (Reflow Peak Temperature : 260 +0/-5°C, 30sec.), Meet IPC/JEDEC J-STD-020 D Standard

- *1 : The figure indicates typical specification. Please refer to individual specifications.
- *2 : Initial measurement : Perform a heat treatment at 150 +0/-10°C for one hour after soldering process. and then let sit for 24±2 hours at room temperature. Perform the initial measurement.
- *3 : Final measurement : Let sit for 24±2 hours at room temperature after test conclusion, then measure.
- *4 : Final measurement : Perform a heat treatment at 150 +0/-10°C for one hour after soldering process. and then let sit for 24±2 hours at room temperature. Perform the initial measurement.
- *5 : Final measurement : Let measure within 24 hours at room temperature after test conclusion.

⚠ 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.

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- ⑦ Undersea equipment
- ⑧ Traffic signal equipment
- ⑨ Data-processing equipment
- ⑩ Electric heating apparatus, burning equipment
- ⑪ Safety equipment
- ⑫ Any other applications with the same as or similar complexity or reliability to the applications