



LLL/LLA/LLM Series Specifications and Test Methods (1)

No.	Item		Specifications	Test Method																								
1	Operating Temperature Range		R7, C7: −55 to +125°C																									
2	Rated Voltage		See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, should be maintained within the rated voltage range.																								
3	Appearance		No defects or abnormalities	Visual inspection																								
4	Dimensions		Within the specified dimension	Using calipers																								
5	Dielectric Strength		No defects or abnormalities	No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																								
6	Insulation Resistance		$C \leq 0.047\mu\text{F}$: More than 10,000MΩ $C > 0.047\mu\text{F}$: More than 500Ω · F C: Normal Capacitance	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.																								
7	Capacitance		Within the specified tolerance	The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table. Frequency: 1±0.1kHz Voltage: 1±0.2Vrms *However the voltage is 0.5±0.1Vrms about LLA185C70G474.																								
8	Dissipation Factor (D.F.)		W.V.: 25V min.; 0.025 max. W.V.: 16V/10V max.; 0.035 max. W.V.: 6.3V max.; 0.05 max.																									
9	Capacitance Temperature Characteristics		<table><tr><th>Char.</th><th>Temp. Range (°C)</th><th>Reference Temp.</th><th>Cap.Change</th></tr><tr><td>R7</td><td>−55 to +125</td><td>25°C</td><td>Within ±15%</td></tr><tr><td>C7</td><td>−55 to +125</td><td>25°C</td><td>Within ±22%</td></tr></table>	Char.	Temp. Range (°C)	Reference Temp.	Cap.Change	R7	−55 to +125	25°C	Within ±15%	C7	−55 to +125	25°C	Within ±22%	<p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>−55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3</td></tr><tr><td>5</td><td>25±2</td></tr></table> <p>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</p>	Step	Temperature (°C)	1	25±2	2	−55±3	3	25±2	4	125±3	5	25±2
Char.	Temp. Range (°C)	Reference Temp.	Cap.Change																									
R7	−55 to +125	25°C	Within ±15%																									
C7	−55 to +125	25°C	Within ±22%																									
Step	Temperature (°C)																											
1	25±2																											
2	−55±3																											
3	25±2																											
4	125±3																											
5	25±2																											
10	Adhesive Strength of Termination		No removal of the terminations or other defect should occur.	Solder the capacitor to the test jig (glass epoxy board) using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *LLL18 and LLA/LLM Series: 5N																								
11	Vibration Resistance	Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).																								
Capacitance		Within the specified tolerance																										
D.F.		W.V.: 25V min.; 0.025 max. W.V.: 16V/10V max.; 0.035 max. W.V.: 6.3V max.; 0.05 max.																										
12	Solderability of Termination		75% of the terminations are to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.																								
13	Resistance to Soldering Heat	Appearance	No marking defects	<p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.</p> <p>• Initial measurement. Perform a heat treatment at 150±5°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p>																								
Capacitance Change		Within ±7.5%																										
D.F.		W.V.: 25V min.; 0.025 max. W.V.: 16V/10V max.; 0.035 max. W.V.: 6.3V max.; 0.05 max.																										
I.R.		More than 10,000MΩ or 500Ω · F (Whichever is smaller)																										
Dielectric Strength		No failure																										

Continued on the following page. 

LLL/LLA/LLM Series Specifications and Test Methods (1)

 Continued from the preceding page.

No.	Item		Specifications	Test Method															
14	Temperature Cycle	Appearance	No marking defects	<div>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.</div> <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp. ±3</td><td>Room Temp.</td><td>Max. Operating Temp. ±3</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table> <div>• Initial measurement. Perform a heat treatment at 150±90 °C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</div>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. ±3	Room Temp.	Max. Operating Temp. ±3	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
		Step	1		2	3	4												
		Temp. (°C)	Min. Operating Temp. ±3		Room Temp.	Max. Operating Temp. ±3	Room Temp.												
		Time (min.)	30±3		2 to 3	30±3	2 to 3												
		Capacitance Change	Within ±7.5%																
		D.F.	W.V.: 25V min.; 0.025 max. W.V.: 16V/10V max.; 0.035 max. W.V.: 6.3V max.; 0.05 max.																
I.R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)																		
Dielectric Strength	No failure																		
15	Humidity (Steady State)	Appearance	No marking defects	<div>Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.</div>															
		Capacitance Change	Within ±12.5%																
		D.F.	W.V.: 10V min.; 0.05 max. W.V.: 6.3V max.; 0.075 max.																
		I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)																
16	Humidity Load	Appearance	No marking defects	<div>Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</div>															
		Capacitance Change	Within ±12.5%																
		D.F.	W.V.: 10V min.; 0.05 max. W.V.: 6.3V max.; 0.075 max.																
		I.R.	More than 500MΩ or 25Ω · F (Whichever is smaller)																
17	High Temperature Load	Appearance	No marking defects	<div>Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</div> <div>•Initial measurement. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 24±2 hours at room temperature. Perform initial measurement.</div>															
		Capacitance Change	Within ±12.5%																
		D.F.	W.V.: 10V min.; 0.05 max. W.V.: 6.3V max.; 0.075 max.																
		I.R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)																