

1. Scope

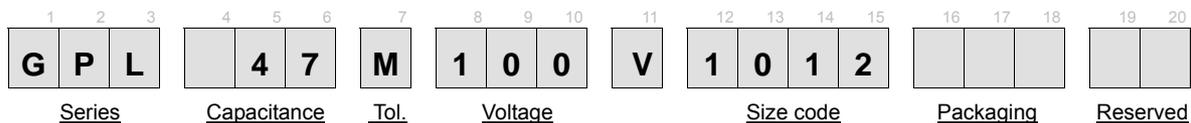
These specifications specify **GPL** series of the Aluminum Solid Capacitors with Conductive Polymer electrolyte.

2. Applicable standards

KS C 6421(W), KS C 6035, except as specified in this specification.

3. Part number

Explanation of part number : 47 uF 100v 10x12mm



Capacitance	Code
47 μ F	47
220 μ F	220
1000 μ F	1000
1500 μ F	1500

Tolerance	Code
$\pm 20\%$	M

Voltage	Code
16V	16
25V	25
35V	35
50V	50
63V	063
100V	100
160V	160

Size	Code
6.3 x 6	0606
6.3 x 9	0609
8 x 8	0808
8 x 12	0812
10 x 10	1010
10 x 12	1012

Description	Code
Bulk	
Lead Taping (ex P5)	T5
Lead Cut (ex 4mm)	C4

4. Operating temperature range

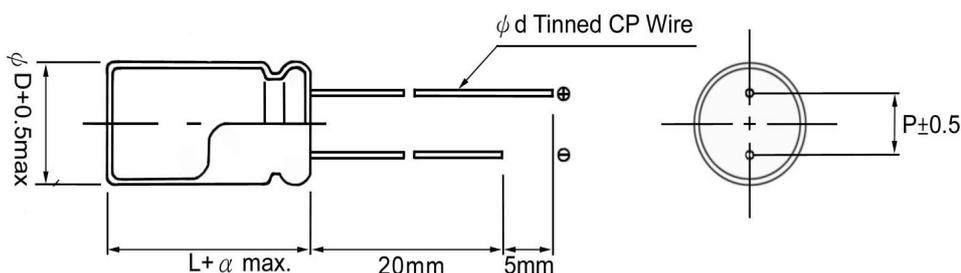
-55 ~ +125

4-1. Rated voltage, Surge, Category voltage and Rated temperature

Rated voltage (V)	Rated temperature ($^{\circ}$ C)	Surge (V)	Category voltage (V)
16	125	18.4	16.0
25	125	28.7	25.0
35	125	40.2	35.0
50	125	57.5	50.0
63	125	72.4	63.0
100	125	115	100.0
160	125	184	160.0
200	125	230	200.0

The sum of DC voltage and the peak of ripple voltage must not exceed the rated voltage.

5. Dimension



For dimensions of ϕD & L, refer to GPL series

Size Code	Size	ϕD	L max.	F	ϕd
0606	6.3 x 6.0	6.3	6.8	2.5	0.45
0609	6.3 x 9.0	6.3	9.8	2.5	0.50
0611	6.3 x 11.0	6.3	12.0	2.5	0.50
0808	8.0 x 8.0	8.0	9.5	3.5	0.60
0812	8.0 x 12.0	8.0	13.5	3.5	0.60
1010	10.0 x 10.0	10.0	10.5	5.0	0.60
1012	10.0 x 12.0	10.0	13.5	5.0	0.60

6. Performance

Test environmental conditions

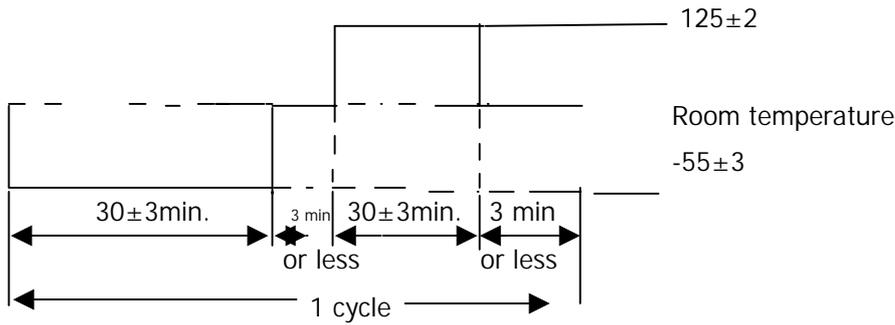
Ambient temperature: 20 \pm 2 $^{\circ}$ C / Relative humidity : 60- 70% / Air pressure : 86- 106 kPa

No.	Item	Test condition	Specification
6.1	Rated voltage		See characteristic table
6.2	Capacitance (Tolerance)	Measuring frequency : 120Hz Measuring voltage : 1.0Vrms or less DC bias voltage : +1.5- 2.0 VDC Measurement circuit : Equivalent series circuit	See characteristic table (M : \pm 20%)
6.3	Tan δ	Measurement shall be made under the same conditions as those given for the measurement of capacitance.	See characteristic table
6.4	ESR	At 20 $^{\circ}$ C in 100 to 300 KHz	See characteristic table
6.5	Leakage Current	Leakage current value after applying the rated voltage for 2 minutes shall be less than the value shown in characteristic table (Item 15). In case Leakage current value exceeds the value shown in Item 15, remember after voltage treatment that applies the category voltage shown in Item 4-1 for 120 minutes at 125 $^{\circ}$ C.	I=0.2CV (after 2 minutes)
6.6	Maximum Permissible Ripple current	Temperature : 105 \pm 2 $^{\circ}$ C Ripple : rms value of 100 KHz sine wave AC (The sum of DC voltage and peak voltage shall not exceed the rated voltage.)	See characteristic table
6.7	Surge voltage	Applied voltage: see item 4-1 Temperature condition: Normal temperature Protective resistor and discharge resistor: 1 k Ω Cycle number: 1000 cycles (A) Charge: 30 \pm 5 seconds (B) Discharge: 5.5 minutes (A) + (B) = 6 \pm 0.5 minutes (as 1 cycle) Performance: The capacitors shall meet the following specification after 1000 cycles.	No visible damage Leakage current \leq specified value Capacitance change : within \pm 20% of initial value tan $\delta \leq$ 1.5 times of specified value ESR \leq 1.5 times of specified value

No.	Item	Test condition			Specification
6.8	High Temperature & Low Temperature characteristics	Step Temperature(°C)			Item
		1	20 ±2	Measure: Capacitance tan δ *Impedance (Z 20°C)	Measure: Capacitance Tangent of loss angle Impedance (Z 20°C)
		2	-55±3	Z/Z 20 1.25	Z -55°C / Z 20°C
		3	Keep at 15 to 35°C for 15minutes or more		-
		4	+125±2	Z/Z 20°C 1.25	Z +125°C / Z 20°C
		5	20±2	ΔC/C :Within±5% of step 1 Tan δ: Less than or equal to the value of item 7.3	ΔC/C 20°C Tangent of loss angle
6.9	Damp heat (steady state)	Z -55°C or +125°C / Z 20°C : Impedance ratio at 100 kHz ΔC/C 20°C : Capacitance change at 120 Hz Tangent of loss angle at 120 Hz			Leakage current ≤ specified value Capacitance change : within ±20% of initial value tan δ ≤ 1.5 times of specified value ESR ≤ 1.5 times of specified value No visible damage
		Temperature : 60±2°C Relative humidity : 90%- 95% Duration: 1,000 (+48/-0) hours (A) Applied voltage: Rated voltage (B) Applied voltage: without load			
6.10	Load life	Temperature : 125 ±2°C Applied voltage : rated voltage Duration : +72/-0 hours (16V 25V 2000 hours, 35V 200V 1500 hours The capacitors shall be stored under standard atmospheric conditions for 1 to 2 hours, after which measurement shall be made.			Leakage current ≤ specified value Capacitance change : within ±20% of initial value tan δ ≤ 1.5 times of specified value ESR ≤ 1.5 times of specified value
		(1) Soldering condition should be under the following ranges. Recommended flow soldering condition			
6.11	Flow soldering		Temperature	Time	Flow number
		Preheating	120°C or less(ambient temperature)	120 sec. or less	1 time
		Soldering conditions	260°C or less	10 sec. or less	2 times or less *1
		*1 When soldering 2 times, immersion time should be 10 sec. or less. *2 Refer to item 1. Considerations when soldering (2) Do not apply flow soldering to SMD type. (3) Do not solder capacitor itself by submerging it in melted solder the opposite side that the capacitor is mounted on. (4) Note that flux does not adhere to anywhere expect the lead terminal. (5) Note that other components do not fall over and touch the capacitor when soldering.			No visible damage Leakage current ≤ specified value Capacitance change : within ±10% of initial value tan δ ≤ 1.3 times of specified value ESR ≤ 1.3 times of specified value

7. Rapid change of temperature

Applied voltage: No load
 Cycle number: 5 Cycles
 Test diagram: Fig. 1



(Fig.1)

Performance: After 5 cycles, the capacitors shall meet the following specification.

Item	Performance
Capacitance change	Within ±10% of initial capacitance
Tan δ	Less than or equal to the value of item 7.3
Leakage current	Less than or equal to the value of item 7.5 (after voltage treatment)

8. Solder-ability

Temperature: 235 ± 5 °C
 Duration: 2 ± 0.5 seconds
 Direction: X, Y, Z (3 axes)
 Flux: Rosin (JIS K 5902) / / Ethanol (JIS K 8101); About 25 wt. %
 Performance: At least 95% of surface area of the dipped portion of the terminal shall be covered with new solder.

9. Resistance to soldering heat

Test condition :

- A) Vapor phase soldering method
 Solder paste should be applied to the printed wiring boards and then the capacitors are mounted on it. After that, the capacitor should be maintained in the vapor phase bath at a temperature of 230 ±2°C for 75 ±1 seconds.
- B) Soldering iron method
 Temperature: 400 ±10°C
 Duration: 3 +1-0 seconds
- C) Flow soldering heat (Do not apply flow soldering to SMD type)
 Temperature : 260±5°C
 Duration : 10 ±1 seconds

Performance: The capacitors shall meet the following specification after A or B test.

Item	Performance
Capacitance change	Within ± 5% of initial capacitance
Tan δ	Tan δ ≤ 1.3 times of specified value
Leakage current	ESR ≤ 1.3 times of specified value

10. Vibration

Frequency : 10 to 5 Hz (1 minute interval / 10 → 55→ 10 Hz)
 Amplitude : 0.75mm (Total excursion 1.5mm)
 Direction : X, Y, Z (3 axes)
 Duration : 2 hours / axial (Total 6 hours)
 Performance : Measured capacitance should be settled when it is within 30 minutes before the end of the test. Also, after the test, the rate of capacitance change is within ±5% of the initial value.

11. Cleaning

Concerning about HCFC, higher alcohol system, petroleum system, terpene system, water system with surface active agent and other solvents the washing way (separateness or combinations) by soak, ultrasonic wave, boil, vapor etc. is confirmed under the maker's recommendation. Please contact us if you require further details. Also, please be attentive to the following note as to some sort of solvent.

Note: Please do not store capacitors in sealed container or in solvent after cleaning. Immediate heating after cleaning may causes expansion and (or) shrink of sleeves.

12. Storage condition

- (1) Store capacitor in a location free from direct contact salt spray or oil spray.
- (2) Store in a location where the capacitor is not exposed to noxious gas as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.
- (3) Store at a temperature between 5 to 35°C, with humidity of 75%RH or less.
- (4) Store capacitor in a location that is not subject to direct sunlight, vibration or contact with water.
- (5) Capacitor sets the storage period to prevent the increase of leakage current through the long-term storage before opening. When make a long-term storage, please storage its as follows.
Open the bags just before mounting and use up all products once opened. For keeping a good solderability, store the capacitor as follows.

(Radial lead type)

Before unseal: within 1 year after delivery

After seal : within 7 days from opening

(SMD type)

Before unseal: within 6 months after delivery

After seal: within 30 days from opening (packaged with carrier tape)

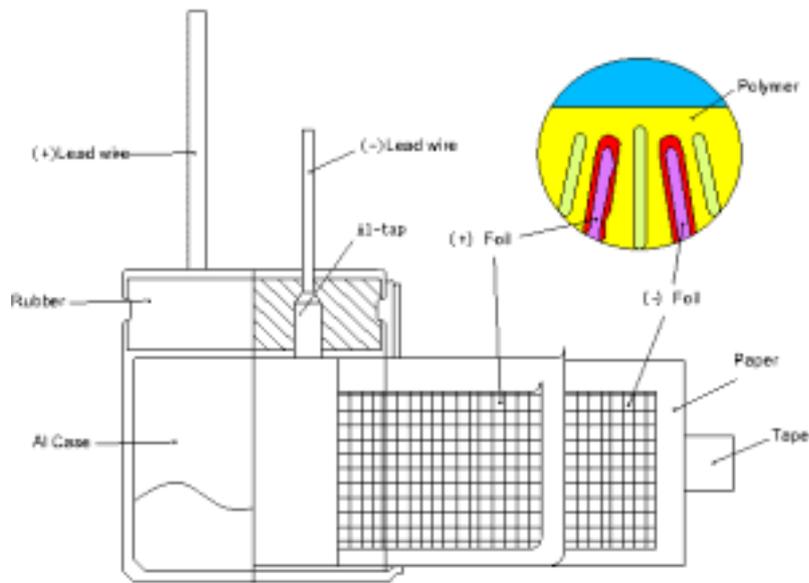
13. Characteristics Table

Rated voltage (V.DC)	Rated Capacitance (μF)	Case Size D x L (mm)	tan δ	Leakage Current (μA)	ESR (mΩ max./ 20°C 100KHz to 300KHz)	Rated ripple current (mArms, 100 KHz)		Part Number
						T _x ≤ 105°C	105°C < T _x ≤ 125°C	
16V	330	8 x 8	0.12	1,056	15	4,300	1,720	GPL-330M16V0808
	470	8 x 8	0.12	1,504	15	4,300	1,720	GPL-470M16V0808
	470	8 x 12	0.12	1,504	13	4,650	1,860	GPL-470M16V0812
	820	8 x 12	0.12	2,624	13	4,650	1,860	GPL-820M16V0812
	820	10 x 12	0.12	2,624	12	5,600	2,240	GPL-820M16V1012
	1,000	10 x 12	0.12	3,200	12	5,600	2,240	GPL-1000M16V1012
	1,200	10 x 12	0.12	3,840	12	5,600	2,240	GPL-1200M16V1012
	1,500	10 x 12	0.12	4,800	12	5,600	2,240	GPL-1500M16V1012
25V	100	8 x 8	0.12	500	24	2,900	1,160	GPL-100M25V0808
	150	8 x 8	0.12	750	24	2,900	1,160	GPL-150M25V0808
	220	8 x 12	0.12	1,100	18	4,250	1,700	GPL-220M25V0812
	330	8 x 12	0.12	1,650	18	4,250	1,700	GPL-330M25V0812
	470	8 x 12	0.12	2,350	18	4,250	1,700	GPL-470M25V0812
	470	10 x 12	0.12	2,350	16	4,700	1,880	GPL-470M25V1012
	560	10 x 12	0.12	2,800	16	4,700	1,880	GPL-560M25V1012
	680	10 x 12	0.12	3,400	16	4,700	1,880	GPL-680M25V1012
35V	47	8 x 8	0.12	329	30	2,600	1,040	GPL-47M35V0808
	68	8 x 8	0.12	476	30	2,600	1,040	GPL-68M35V0808
	100	8 x 12	0.12	700	26	2,950	1,180	GPL-100M35V0812
	150	8 x 12	0.12	1,050	26	2,950	1,180	GPL-150M35V0812
	180	8 x 12	0.12	1,260	26	2,950	1,180	GPL-180M35V0812
	220	8 x 12	0.12	1,540	26	2,950	1,180	GPL-220M35V0812
	220	10 x 12	0.12	1,540	24	3,400	1,360	GPL-220M35V1012
	330	10 x 12	0.12	2,310	24	3,400	1,360	GPL-330M35V1012
	390	10 x 12	0.12	2,730	24	3,400	1,360	GPL-390M35V1012
50V	47	8 x 12	0.12	470	32	2,250	900	GPL-47M50V0812
	68	8 x 12	0.12	680	32	2,250	900	GPL-68M50V0812
	82	8 x 12	0.12	820	32	2,250	900	GPL-82M50V0812
	120	8 x 12	0.12	1,200	32	2,250	900	GPL-120M50V0812
	120	10 x 12	0.12	1,200	28	2,620	1,040	GPL-120M50V1012
	180	10 x 12	0.12	1,800	28	2,620	1,040	GPL-180M50V1012
	220	10 x 12	0.12	2,200	28	2,620	1,040	GPL-220M50V1012
63V	82	8 x 12	0.12	1,033	32	2,100	840	GPL-82M100V0812
	100	8 x 12	0.12	1,260	32	2,100	840	GPL-100M63V0812
	150	10 x 12	0.12	1,890	28	2,550	1,020	GPL-150M63V1012
	180	10 x 12	0.12	2,268	28	2,550	1,020	GPL-180M63V1012
100V	15	8 x 12	0.12	300	40	1,850	740	GPL-15M100V0812
	22	8 x 12	0.12	440	40	1,850	740	GPL-22M100V0812
	33	10 x 12	0.12	660	38	2,100	840	GPL-33M100V1012
	47	10 x 12	0.12	940	38	2,100	840	GPL-47M100V1012
160V	4.7	8 x 12	0.12	150	130	720	280	GPL-4.7M160V0812
	6.8	8 x 12	0.12	217	130	720	280	GPL-6.8M160V0812
	12	10 x 12	0.12	384	130	960	380	GPL-12M160V1012

- Frequency coefficient of allowable ripple current

Frequency	120 Hz ≤ f < 1 KHz	1 KHz ≤ f < 10 KHz	10 KHz ≤ f < 100 KHz	100 KHz ≤ f ≤ 300 KHz
Coefficient	0.05	0.30	0.70	1.00

15. Structure



Lead wires: Oxygen Free Copper (OFC) wires

Al-boss: High pure aluminum

Paper: Manila hemp

Al-foil (Anode): High pure aluminum

Al-foil (Cathode): High pure aluminum

Al-case: High pure aluminum

Tape: Polyester

The lead wire and the Al-boss are welded together.

The Al-tab and the Al-foil are stitched to join together.

The outer most Al-foil spiral of the element is cathode.

Conductive polymer is used as the electrolyte.

16. Operating Precautions

This capacitor is an aluminum solid capacitors with Conductive Polymer electrolyte.

Please note the following points in order to take full advantage of products performance, with most stable quality.

Crucial Precautions

1. Polarity

Solid aluminum electrolytic capacitor is a polarized capacitor including positive and negative electrodes. Do not reverse the polarity when using. If it is used with the polarities reversed, increased leakage current or decreased life span may result.

2. Prohibited circuits

Since problems can be expected due to leakage current increasing during soldering and other processes, the capacitor cannot be used in the following circuits.

- 1) High impedance circuits
- 2) Coupling circuits
- 3) Time constant circuits

* In addition to the leakage current fluctuation above, the operational conditions such as characteristics at high and low temperature, damp heat and endurance stipulated in the specifications will affect the capacitance. The fluctuation of the capacitance may cause problem if it is used as a time constant capacitor, which is extremely sensitive to the fluctuation of the capacitance. Do not use it as a time constant capacitor

- 4) Circuits to get bad influence by big leakage current

Additionally, please contact usage of two or more capacitors in series for voltage proof.

3. Overvoltage prohibited during design

Overvoltage exceeding the rated voltage may not be applied even for an instant as it may cause a short circuit.

4. Sudden charge and discharge restricted

Sudden charge and discharge restricted (for maintenance of high-proof reliability).

A protection circuit is recommended for when a sudden charge or discharge causes excessive rush current because this is a main cause of short circuits and large leakage current.

Use protection circuits under the following both cases;

- 1) The rush current exceeds 10A.
- 2) The rush current exceeds 10x the maximum allowable ripple current of capacitor.

Be sure to insert a protection resistor of about 1K Ω for charge and discharge when measuring the leakage current.

5. Operating environmental restrictions

Do not use the capacitor in the following environments.

- (a) Places where water, salt water or oil can directly fall on it, and places where condensation may form.
- (b) Places filled with noxious gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
- (c) Places susceptible to ozone, ultraviolet rays and radiation.

6. Mounting precautions

- (1) Considerations when soldering

The soldering conditions are to be within the range prescribed in specifications.

If the specifications are not followed, there is a possibility of the cosmetic deflection, the intensive increase of leakage current, and the capacitance reduction.

- (2) Things to be noted before mounting

- (a) Do not reuse capacitor that have been assembled in a set and energized. Excluding capacitor that have been removed for measuring electrical characteristics during a periodic inspection, this capacitor cannot be reused.

- (b) Leakage current may increase when capacitors are stored for a long period of time. In this case, apply rated voltage for 2 hours at 125°C with load of 1 K Ω resistor.

- (3) Flow soldering

Do not use flow soldering for SMD type.

- (4) Reflow soldering

- (a) Set the soldering conditions (soldering temperature, terminal submersion time) so that they fall within the stipulated range in the specifications. The leakage current value after soldering may increase a little (from a few μ A to several mA) depending on the soldering conditions (preheating and solder temperature and time, PCB material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage.

- (b) Reflow soldering may reduce the capacitance of products after soldering even when the soldering conditions are within the required value.

- (5) Handling after soldering
- (a) Do not tilt, bend or twist the capacitor after it

7. Disposal

Conducting polymer capacitor comprises solid organic compounds, various metals, rubber, etc. Treat it as industrial waste when disposing of it. In case of disposing a large amount of capacitors, the company can dispose on behalf.

8. Consideration when using in industrial equipment

To ensure reliability when the capacitor is used in industrial equipment, design must allow for its capacitance, impedance, and other characteristics.

9. Using in equipment regarding human life

In case of using in equipment regarding human life (e.g. Space equipment, aeronautic equipment and atomic equipment etc.), be sure to talk over the matter with supplier. Don't use without recognition document of our company.

10. Hazardous substances for Environmental care

10-1. Substances destroying ozone layer

Substances (class one and two) destroying the ozone layer are not contained in this kind of Capacitor. It is not used in manufacturing process of the capacitor.

10-2. Bromine materials for flame-retardant

Conducting polymer capacitor dose not contain bromine materials of PBBOs or PBBs as the flame-retardant

11. Others

Design circuits after checking the following items

- (a) Electric characteristics are affected by temperature and frequency fluctuations. Design circuits after checking the following items.
- (b) When mounting an capacitor on a double-sided PC board, extra PC board holes and the through holes for connecting the front and back of the PCB must not exist underneath the capacitor.

Precautions with completed board

- (a) Do not touch the lead terminals of capacitor directly.
- (b) Do not use electric conductors to cause short circuits between the capacitor lead terminals. Do not subject the capacitor to conductive solutions such as acids and alkaline water solutions.
- (c) Check the installation environment of the board the capacitor is installed in.
- (d) Age the board at conditions that fall below the capacitors ratings.
- (e) It is recommended that the board be used at room temperature and in ordinary humidity.

Fixatives and coatings

- (a) Select the appropriate covering and sealant material for capacitors. In particular, make sure the fixative, coating and thinner do not contain acetone.
- (b) Before applying the fixative or coating, completely remove any flux residue and foreign matter from the area where the board and capacitors are to be jointed together.
- (c) Allow any detergent to dry before applying the fixative or coating.
- (d) Please contact QAI for fixative and coating heat curing conditions.

Note:

In case of some problems concerning industrial possessive rights of third party by using this product, we don't take responsibility except for what to be directly conceded with structure processes capacitor. Please design with safety measures taking into consideration any social damage, such as personal or fire accident when using this product.
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