1. Scope

This is the product specification applying to electric double layer capacitor .
Please study and approve this specification.

2. Structure and Form

1) Structure
Aluminum-can case and rubber cover is outer structure. Inside structure consists of winded anode and cathode electrodes with two separators.

2) Form
Cylindrical and both leads(or snap-in/screw terminal) were extracted with one-direction form.

3. General Characteristics

1) Electric Double Layer Capacitors (EC Series)

- High Power EC Series

(at 25℃)

ITEM	VALUE
Operating voltage (V_R)	2.7 V
Operating Temperature (Tmin~Tmax)	- 40 ℃ ~ + 65 ℃
Storage Temperature (Tmin~Tmax)	- 40 ℃ ~ + 70 ℃
Capacitance Tolerance	- 10 % ~ + 30 %

Part Number	Rated Cap. (F)	ESR (1kHz, mΩ)	Size (mm)		Weight (g)	Volume (ml)	*Rated Current (A)	**Max. Current (A)	Energy Density		Terminal type
			ϕD	L					(Wh/kg)	(Wh/L)	
VEC2R7105QG	1	90	8	13	1.1	0.7	0.26	1.23	0.92	1.55	Lead

Note, * Rated Current : 5 sec. discharge rate to 1/2V_R VDC
** Max. Current : 1 sec. discharge rate to 1/2V_R VDC

- High Power Module EC Series (Type : I)

(at 25℃)

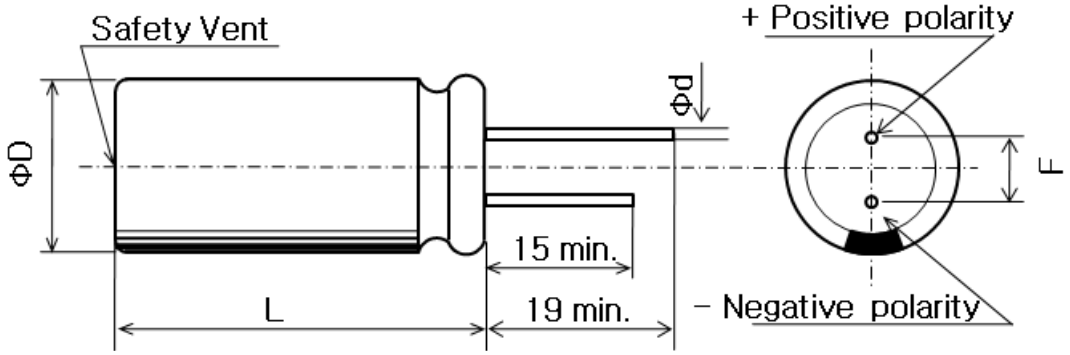
ITEM	VALUE
Operating voltage (V_R)	5.4 V
Operating Temperature (Tmin~Tmax)	- 40 ℃ ~ + 65 ℃
Storage Temperature (Tmin~Tmax)	- 40 ℃ ~ + 70 ℃
Capacitance Tolerance	- 10 % ~ 30 %

Part Number	Rated Cap. (F)	ESR (1kHz, mΩ)	Size (mm)			Weight (g)	Volume (ml)	*Rated Current (A)	**Max. Current (A)	Energy Density	
			ϕD	L	W					(Wh/kg)	(Wh/L)
VEC5R4504QG	0.5	190	8.5	15.5	17.0	2.6	2.2	0.26	1.22	0.78	0.90

Note, * Rated Current : 5 sec. discharge rate to 1/2V_R VDC
** Max. Current : 1 sec. discharge rate to 1/2V_R VDC

4. Dimension (Unit : mm)

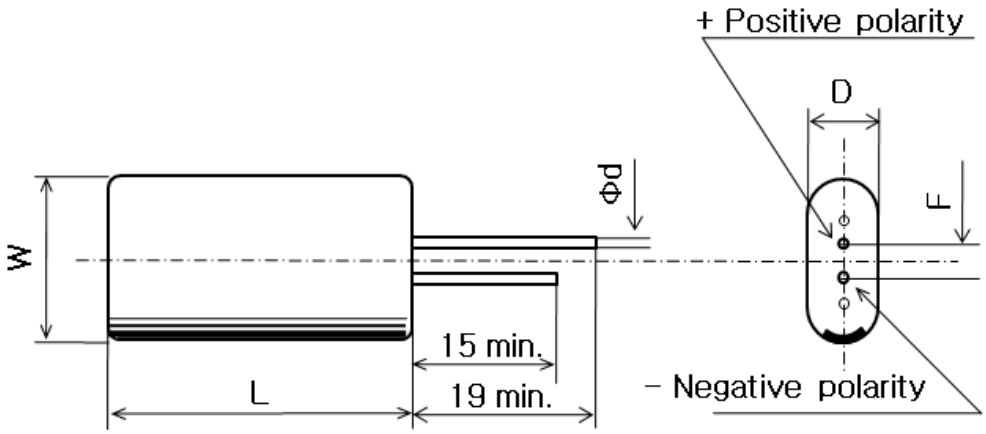
1) Lead terminal type



Part Number	Rated Voltage(V)	Rated Cap.(F)	ϕD	L	ϕd	F
VEC2R7105QG	2.7	1	8 +1.0Max	13 ±1.5	0.6 ±0.1	3.5 ±0.2

2) 2Series Module

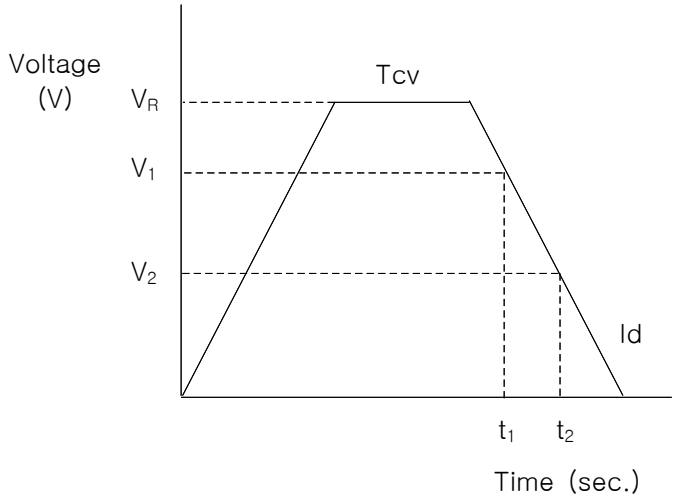
- Type I



Part Number	Rated Voltage (V)	Rated Cap.(F)	D (+1.0Max)	L (±1.5)	W (±1.0)	F (±0.2)
						Type I
VEC5R4504QG	5.4	0.5	8.5	15.5	17.0	4.7

5. Measuring method

1) Capacitance(F)



Item	Value
Tcv	30 min.
Id	1 mA/F
V_1	$0.8V_R$ V
V_2	$0.4V_R$ V

where

V_R is Rated Voltage (V)

T_{CV} is the time holding Rated Voltage (Min.)

Id is the discharge current (A)

$$C(F) = \frac{i \times |t_2 - t_1|}{|V_1 - V_2|}$$

C (Capacitance) : F

i (Current) : A

t (Time) : sec.

V (Voltage) : V

2) Equivalent Series Resistance (AC ESR)

- AC ESR is measured by 4-probe impedance analyzer at the following conditions.

Condition : Potentiostat mode, AC amplitude: 5mV, Frequency: 1kHz

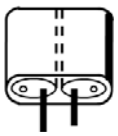
6. Specification and Test method

Item		Specification		Test Method
Cycle Life	△C	≦ 30% of Initial Value		.1Cycle : V_R and 1/2V_R under constant current at 25℃ ① EC Series : 500,000cycles
	△ESR	≦ 2 times of Spec. Value		
	Appearance	No remarkable change		
High Temp. Load Life	△C	≦ 30% of Initial Value		.Temp.: Tmax±2℃ .Voltage: V_R VDC .Resistance: 0Ω .Test Time : ① Tmax=65℃:1,000 (+24)hrs
	△ESR	≦ 2 times of Spec. Value		
	Appearance	No remarkable change		
Low Temperature Characteristics	△C	Step2	≦ 5% of Initial Value	.Temp.: Tmin ±2℃ .Storage time : 12hrs .No load
	△ESR		≦ 2 times of Spec. Value	
	Appearance		No remarkable change	
Cycle Temperature	△C	≦ 30% of Initial Value		.Temp.: Tmin→25℃→ Tmax→25℃ .Cycle : 5 cycle
	△ESR	≦ 2 times of Spec. Value		
	Appearance	No remarkable change		
Vibration Resistance	△C	≦ 30% of Initial Value		.Amplitude: 1.5mm .Frequency: 10~55Hz .Direction: X,Y,Z (2hrs) .Total Time : 6hrs
	△ESR	≦ 2 times of Spec. Value		
	Appearance	No remarkable change		
Hand Soldering	Cap.	Spec. Value		.Solder Temp. : 310±5℃ .Immersion time: 3±1sec.
	ESR	Spec. Value		
	Appearance	No remarkable change		

7. Part Number System

V	E	C	5	R	4	5	0	4	Q	G	-	I

Module Type Code

I


Design Code

Capacitance Tolerance

Tolerance	Symbol
-10%~+30%	Q

Capacitance Code

: 504 (0.5F / 50 × 10^4 μF)

Rated Voltage

Rated Voltage	5.4V
Symbol	5R4

Series Name

Series	Symbol
VINA EDLC Capacitor	VEC

8. Package

Part number	Quantity (pcs)			Size (W × L × H, mm)	Weight (Kg)
	Plastic bag	Inner box	Box		
VEC5R4504QG	200	1,600	3,200	420 × 300 × 240	9.8

- Plastic bag package

a) Plastic bag

b) Inner box

c) box

d) box

9. Notes on Using the Hy-Capacitor

Environmental Condition

1. Hy-cap is packaged in a rubber-capped aluminum case containing organic electrolyte. For safe usage, it is proposed that you avoid using or storing Hy-cap in any of conditions below.

   - Direct contact with water or oil
   - Direct sunlight
   - High temperature and/or humidity
   - Chemically active gas
   - Acid or alkaline environment

2. Any of the following phenomena indicates that Hy-cap has failed ; then, disconnect it immediately from electrical supply and contact Vinatech.

   - When surface temperature of Hy-cap exceeds upper limit within a few minutes after connection to electrical supply.
   - When odor of gas discharged from Hy-cap can be smelled
   - When Hy-cap gets swollen
   - When electrical sparking occurs around the terminals under high current condition

Circuitry

1. Ensure that maximum operating voltage and other values are selected reliably. Overvoltage may damage Hy-cap by causing abrupt increase of leakage current, overheating, decrease in capacitance, and increase of internal resistance.

2. Hy-cap is polarized ; so do not apply reverse voltage. When using the capacitor, be sure to confirm the capacitor's polarity marking.

3. A serially connected module of Hy-cap cells may exhibit voltage unbalance among individual cells. When the serial module in such state is charged up, one or more cells may become subject to overvoltage. Overvoltage should be avoided because it causes faster deterioration of capacitance and internal resistance of Hy-cap and may lead to premature failure. Therefore, when using serially connected module, please pay attention to the following guidelines:

   - The tolerance of capacitance of Hy-cap is -10% to +30% of nominal capacitance. This means the capacitance difference could be up to maximum 40% between capacitors. In a series-connected module, the disparity in capacitance adversely affects the final voltage

distribution of capacitors when the module is fully charged up. For example, consider an extreme case of a module where two capacitors differing in capacitance by 40% are connected in series. When this module is charged to 5.4V, then the voltages of the capacitors shall become 2.5V and 2.9V(for example), respectively, causing a voltage disparity of 0.4V. The more capacitors are connected in series, the greater the voltage disparity shall become, and resulting overvoltage conditions for some of the capacitors may eventually cause their premature failure. Therefore, when designing a series-connected module, the recommendation is to calculate acceptable tolerance level of capacitance disparity as a function of total number of capacitors in the module and then select for the module only those capacitors falling within the calculated tolerance range.

- For safety's sake, Vina-tech recommends the design rule where the rated voltage of each cell is assumed to be less than 2.5V in case of connecting 2.7V Hy-cap in a serial module. Therefore, in case of two series of 2.7V cap, maximum voltage of the serial module should be less than 5.0V.

- Hy-cap is unique in having OCV(open circuit voltage) of about 0.1V. If capacitors have different initial voltage readings, then even after being connected in series, the voltage disparity is maintained. Thus, you have to check beforehand whether each capacitor has capacitance in the range of acceptable capacitance tolerance for your application. Also, you must be careful not to short terminals or leads which may cause voltage to get worse.

- After a series-connection of Hy-cap and before charging, you should check the voltage of each cell to see whether voltage variation among capacitors is less than 0.1V. If voltage difference is greater than 0.1V, then adjust voltages of capacitors down to a specific voltage(0V) by using Resister(a few ohms)

4. It's recommended to place a balancing resistor in connecting in series more than 3 pieces

5. Avoid repeated quick charges and discharges, which may cause Hy-cap to overheat and lead to decrease in capacitance and increase in internal resistance and adversely affect useful life of the module.

6. Hy-cap life is closely related with ambient temperature. If temperature is lowered by 10℃, lifetime of the capacitor will be approximately double. Therefore, in order to ensure long life, the product should be used at temperature lower than the rated maximum temperature.

7. If Hy-cap are part of a circuitry or a system, avoid contacting both ends of the terminals with conductive material as if may cause discharge of very high current exceeding several thousand amperes.

Mounting

1. Do not scratch or file the lead(or snap-in/screw) terminals. The terminals are coated with metal and the removal of the coated metal will cause poor solderability.

2. When using flow soldering, ensure that the soldering temperature is max. 260℃ and time cannot exceed 5 seconds.

3. Avoid mechanical impacts such as dropping on the floor or touching with a hard blade to prevent sleeve and pin's waves and deformation.

4. Vinatech recommends utilizing PCB when connecting Hy-cap to a circuit or electric device. Please avoid connecting wire directly to the capacitors. In addition, avoid positioning exothermic components near Hy-cap or on the opposite side of the PCB.

5. Please maintain minimum distance of 5mm between the surface of Hy-cap and the housing in order to allow for unimpeded venting of gas through the safety vent if such case occurs.

6. In case of screw terminal type, the part of a safety vent should be upward; otherwise, electrolyte inside could leak out.

Cleaning

Basically do not wash Hy-cap. It may cause contamination, corrosion, and short-circuit.

Storage

1. Do not keep in high temperature and high humidity environment. Store the products in a place where the temperature is between 5℃~30℃ and the relative humidity is less than 60%.Avoid exposure to abrupt temperature changes, which may cause water condensation and deterioration of the product.
   - Store the product in room temperature and normal humidity
   - Avoid exposing the product in direct sunlight for extended period; it may cause deterioration or discoloration of the sleeve.

2. During storage, do not cause short-circuit by touching both terminals of the capacitor simultaneously with a conductive material.

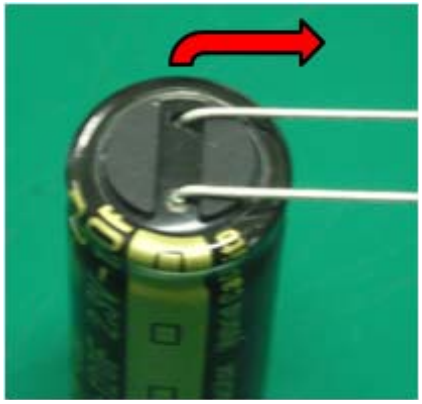
3. Do not store the product in an ambient atmosphere containing water-droplets or toxic gases.

4. Avoid exposure to acid or alkaline liquids, vapor and/or toxic gases.

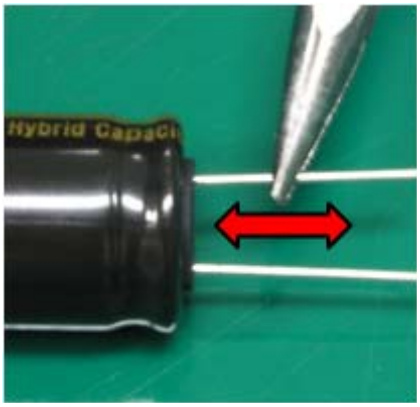
5. Do not disassemble Hy-cap.

⚠ Caution

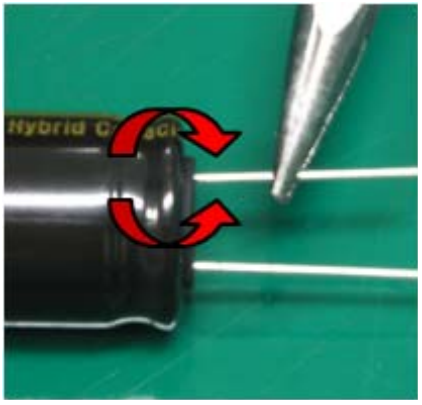
When handling the terminals or lead wires, Do not deform(picture a), pull(picture b) or twist(picture c). The terminals or lead wires are attached to the electrodes in the interior of the aluminum case and are tightly embedded in the rubber-cap sealing case. Repeated or forceful bending, pulling or twisting of the lead wire may create a path opening wider alongside the wire in the rubber-cap for electrolyte to leak out. The electrolyte leakage may not only shorten the useful life of the Hy-cap, but also cause corrosion and/or short-circuit. If deforming of the lead wire is unavoidable or essential to the assembly process, then please use a needle-nose plier to bend the lead wire while clinching the base of the same by using another needle-nose plier(picture d) so that the force applied to the wire is not transmitted to the rubber-cap.



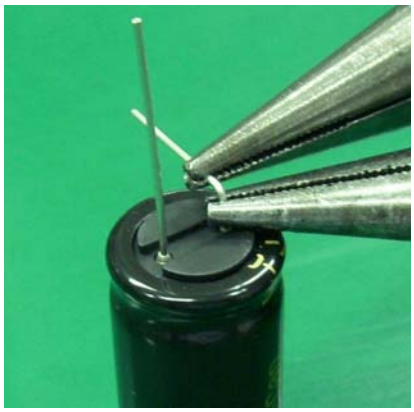
(a) X



(b) X



(c) X



(d) O