

Panasonic

Electric Double Layer Capacitor

“Gold Capacitors”



Panasonic Industrial Company
Product Management Dept.
2004

What is a ... Gold Capacitor ?



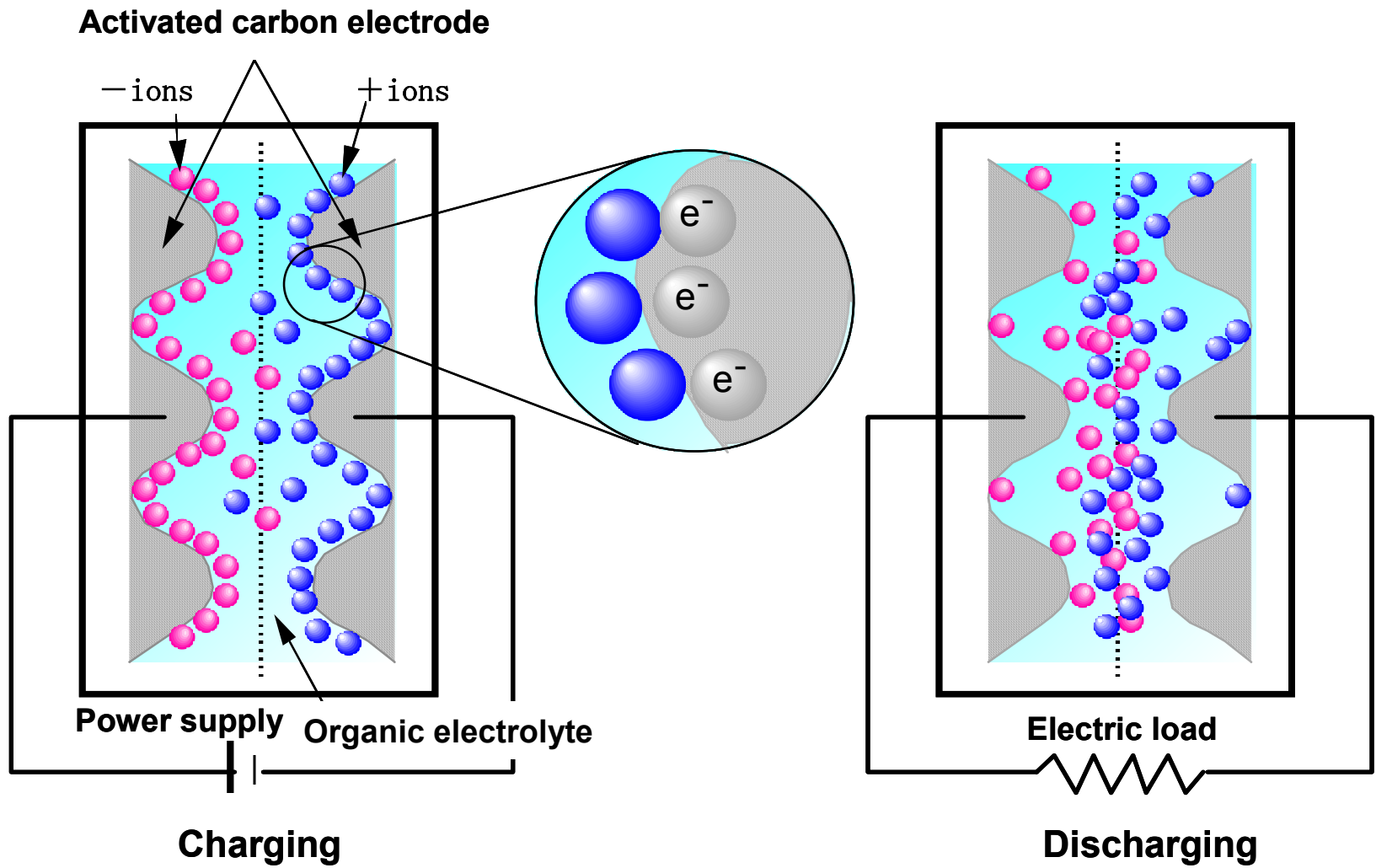
Electric Double Layered Capacitors, known as “Gold Capacitors”, offer the highest volumetric efficiency of all capacitor technologies. It is often compared to a secondary battery. Unlike batteries, the Gold Capacitor does not rely on a chemical reaction to produce electric current rather it is a storage cell that utilizes the absorption/release reaction of ions.

The Panasonic Gold Capacitor has no limit to the number of charge and discharge cycles it can sustain, and does not need a charging circuit. Repeated rapid charge and discharge cycles are also acceptable.

Additionally, the Panasonic Gold Capacitor EN series can withstand re-flow soldering peak temperatures up to 240 deg. C.

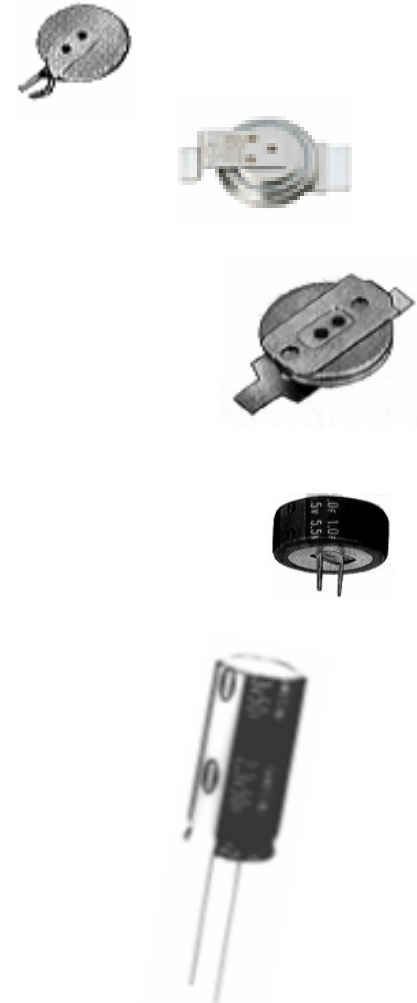
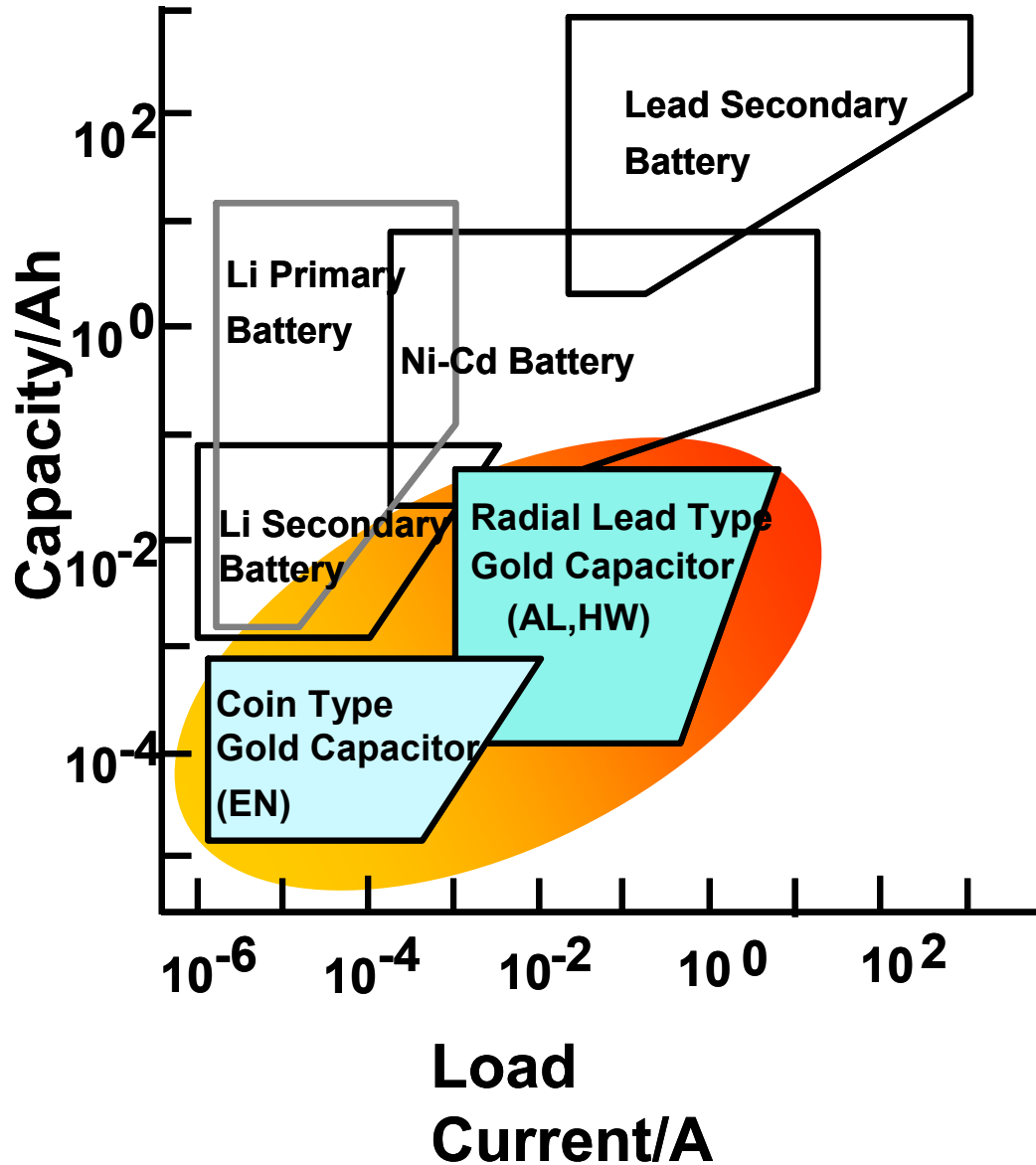
With its miniature size (6.8mm diameter) and four different terminal styles, this capacitor is ideal for small handheld or portable devices

Principle of Operation of a Gold Capacitor



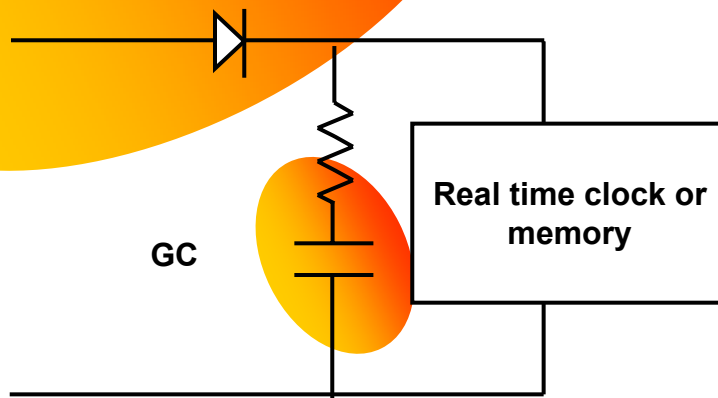
Charging and discharging occurs by the **absorption and release reaction of ions** in the electric double-layer which is formed between the electrode layer and the electrolyte layer. Gold Caps are also called Electric Double Layer Capacitors (ELDC)

Storage Capabilities of a Gold Capacitor

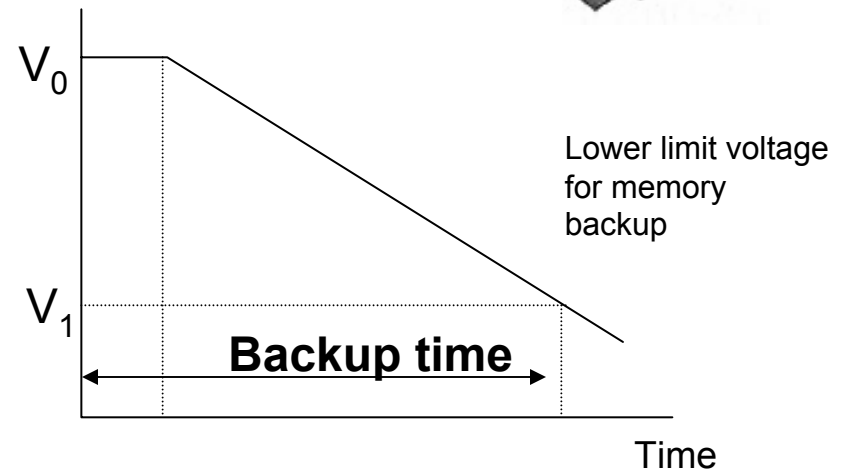


Storage Capabilities of a Gold Capacitor

$$T = C (V_0 - V_1) / (I + I_L)$$



Capacitor's voltage



Example:

$$V_0 = 2.5V, \quad V_1 = 1.8V, \quad I = 10\mu A, \quad C = 0.2F$$

$$\begin{aligned} T &= 0.2 (2.5 - 1.8) / (10 \text{ e-}6 + 0.2 \times 10^{-6}) \\ &= 0.14 / 10.2 \times 10^{-6} \\ &= 13,725 \text{ seconds} \\ &= 3.8 \text{ hours} \end{aligned}$$

- T: Backup time (second)
- C: Capacitance of Gold Capacitor (F)
- V_0 : Applied voltage(V)
- V_1 : Lower limit voltage for memory backup(V)
- I: Current during backup(A)
- I_L : Leakage current(A) about 0.2 μ A

Storage Capabilities of a Gold Capacitor



1. No recycling is required

Recycling is unnecessary (required for batteries)

2. Stable charge and discharge cycle

Life is not affected by charging/discharge cycles because there is no chemical reaction

3. Quick charge & discharge

Seconds or minutes charge time is enough for use .

Note: Longer time is necessary for full charge.

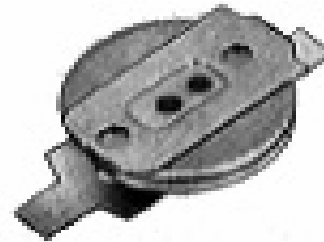
4. Wide operating temp range.

Available for -25°C to +85°C

Note : Temp range depends on the series, please check data sheet for details.

Comparison with Batteries

	Electric Double Layer Capacitor	Secondary Battery
Environment	Friendly	harmful
Charge and discharge Cycle Life	∞	Thousands of times
Operating temperature	-25 to +60deg.C	-10 to +60deg.C
Capacity	1	20



Gold Capacitor Product Line

Wound Type

60°C

Series HW

φ 8/12.5/18

4.7 to 70 F/2.3V
1000h/60°C



SMD Coin Type

60°C

Series EN

φ 6.8

0.2 F/3.3V
500h/60deg



UNDER DEVELOPMENT



For Reflow

Stack Coin Types

85°C

Series F

φ 13.5

0.047 to 0.1 F/5.5V
1000h/85deg



φ 21.5

0.47 to 1.0F/5.5V
1000h/85deg

70°C

Series NF

φ 12.5

0.1 to 0.22 F/5.5V
1000h/70deg



φ 21.5

0.47 to 1.5F/5.5V
1000h/70deg

Series SD

φ 10.5

0.022 to 0.33F/5.5V
1000h/70deg



Series SG

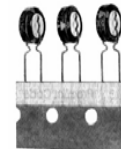
φ 19

0.47 to 1.5F/5.5V
1000h/70deg

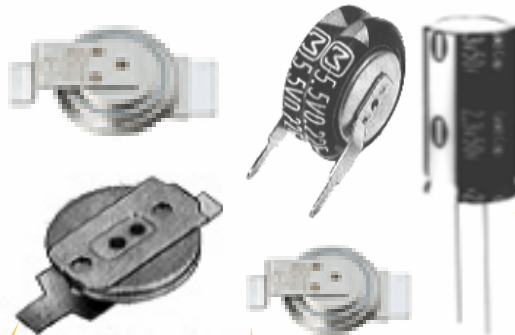
Series SE

φ 10.5

0.022 to 0.22 F/5.5V
1000h/70deg



Gold Capacitors



Panasonic ideas for life